2008~2009년도 대한의용생체공학회 제17대 임원

직 책	성 명	소 속	직 책	성 명	소 속
회장	김선일	한양대		김동욱	전북대
수석부회장	정도언	서울대	교육이사	김주명	광양보건대학
부회장	조진호	경북대		김서확	서울중앙병원
	문창호	리스템(주)	학술이사	김동윤	연세대
감사	이수열	경희대	편집이사	이상훈	고려대
	이경중	연세대	정보이사	안원식	서울대
총무이사	우응제	경희대	국제협력이사	강 곤	경희대
기획이사	탁계래	건국대	산학협력이사	박희병	의료기기협동조합
재무이사	김영곤	인제대	회원관리이사	최보영	가톨릭대

◎ 학술위원회 명단 ◎

성 명	소 속	성 명	소 속	성 명	소 속
김동윤 위원장	연세대	이병채	용인송담대학	정병조	연세대
김경섭	건국대	최흥호	인제대	서종모	서울대
박승훈	경희대	유문호	전북대	이종민	한양대
신동익	서울중앙병원	김경아	충북대	이 윤	고려대

◎ 교육위원회 명단 ◎

성 명	소 속	성 명	소 속
김동욱 위원장	전북대학교 바이오메디컬공학부	윤의중	가천의과학대학교 의용공학과
김주명	광양보건대학 병원의료공학과	윤종인	대구카톨릭대학교 의공학과
김서확	서울중앙병원	이규백	고려대학교 생체의공학과
김성민	건국대학교 의학공학부	이기영	관동대학교 의료공학과
김영곤	인제대학교 의용공학과	이동훈	동명대학교 의용공학과
김영서	을지대학교 의료공학과	이석재	서남대학교 의용공학과
김인영	한양대학교 전기제어생체공학부	이수열	경희대학교 동서의료공학과
김한성	연세대학교 의공학부	이호식	동신대학교 병원의료공학과
김휘영	동주대학 의료기공학과	임용규	상지대학교 한방의료공학과
문정환	성균관대학교 생명공학부	임재근	극동정보대 보건의료공학과
박기영	전주비전대학 의료기정보과	최병철	춘해대학 의료공학과
박해암	남부대학교 의료공학과	최승한	대구한의대학교 한방의용공학과
송민종	광주보건대학 의료공학과	태기식	건양대학교 의공학과
심은보	강원대학교 기계메카트로닉스공학부		

◎ 정보위원회 명단 ◎

직 책	성 명	소 속	직 책	성 명	소 속
정보위원장	안원식	서울대	**정보위원**	서광석	서울대
정보위원	최성욱	강원대	**정보위원**	임영진	서울대

◎ 편집위원회 명단 ◎

직 책	성 명	소 속	직 책	성 명	소 속
편집위원장	이상훈	고려대	**편집위원**	최진욱	서울대
편집위원	이수열	경희대	**편집위원**	김영호	연세대
편집위원	이종민	한양대	**편집위원**	엄광문	건국대
편집위원	권성훈	서울대	**편집위원**	남윤기	KAIST
편집위원	최귀원	한국과학기술연구원	**편집위원**	이계한	명지대
편집위원	이규백	고려대	**편집위원**	권익찬	한국과학기술연구원
편집위원	유선국	연세대	**편집위원**	한동근	한국과학기술연구원
편집위원	송태경	서강대	**편집위원**	송병섭	대구대
편집위원	오창현	고려대	**편집위원**	임창환	연세대
편집위원	예종철	KAIST	**편집위원**	신정욱	인제대

◎ 충북대학교 조직위원회 임원 ◎

▶ **준비위원장 :** 충북대학교 차은종
▶ **준비위원 :** 이태수, 김경아

2008년도

제37회 대한의용생체공학회 춘계학술대회

"Biomedical Optics in Korea"

일 시 2008년 5월 9일(금) - 10일(토)

장 소 충북대학교 개신문화관

주 최 대한의용생체공학회

주 관 대한의용생체공학회, 충북대학교

후 원 한국과학기술단체총연합회, 한국학술진흥재단,
한국의료기기공업협동조합,
충북대학교 휴대형진단치료기기개발센터,
(주)리스템, (주)솔고바이오메디칼

사단법인 대한의용생체공학회
The Korean Society of Medical & Biological Engineering

2008년도 대한의용생체공학회 춘계학술대회 프로그램

1. 춘계학술대회 일정 및 장소

| 일정 | 2008년 5월 9일(금요일) – 10일(토요일)

| 장소 | 충북대학교 개신문화관

2. 세부 일정 개요

5월 9일 (금)				
시간 / 장소	A (대강당)	B (1층 회의실)	C (2층 강의실)	D (2층 로비)
09:00 ~	등 록			
09:30 ~ 11:30	튜터리얼			
11:30 ~ 13:00	점심식사			
13:00 ~ 14:30	개회식 및 특강			
14:30 ~ 15:00	총 회			포스터 Ⅰ
15:00 ~ 16:00				
15:30 ~ 18:00	학생논문경연	구연 Ⅰ	구연 Ⅱ	
18:00 ~	만 찬			

5월 10일 (토)				
시간 / 장소	A (대강당)	B (1층 회의실)	C (2층 세미나실)	D (2층 로비)
09:00 ~ 10:30				포스터 Ⅱ
10:30 ~ 12:30		구연 Ⅲ	구연 Ⅳ	

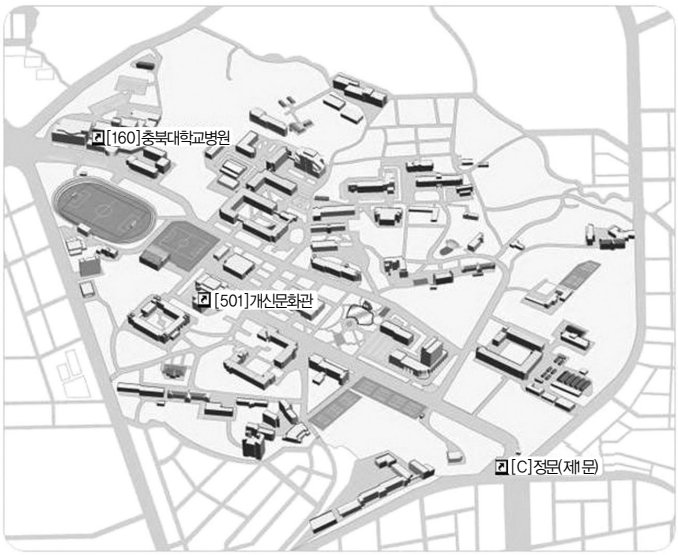
5월 9일 (금)

- Tutorial : (좌장 : 정병조)
  Introduction to Biomedical Optics – 윤종인 (대구가톨릭대학교)
  Current technology and research trends in Biomedical Optics – 김지현 (경북대학교)
- 특강 : Photonics Industry in Korea – 신용진 (조선대학교)
- 포스터 Ⅰ : 영상, 재활, 조직공학, 미세나노, 의료정보, 임상공학
- 구연 Ⅰ : 특강주제 (좌장 : 정병조, 윤종인)
- 구연 Ⅱ : 영상분야 (좌장 : 이종민, 최흥호)

5월 10일 (토)

- 포스터 Ⅱ : 심혈관계, 의료기기, 신경공학, 의공학신기술
- 구연 Ⅲ : 심혈관계, 의료기기 (좌장 : 이태수, 최병철)
- 구연 Ⅳ : 의공학신기술, 신경공학, 재활공학 (좌장 : 탁계래, 김경환)

※ 학회장소 : 충북대학교 개신문화관



오시는 길 안내

교 통 별	출 발 지	도 착 지	목 적 지 (충북대학교)
고속버스	서울, 동서울, 상봉, 대구, 부산, 광주시고속터미널	청주고속버스 터미널	• 거리 : 약 4km • 택시요금 : 약 2,000~2,500원 정도 • 시내버스 : 기본요금(신탄진, 부강, 척산, 미평행)
시외버스	각도시 시외버스 터미널	청주시외버스 터미널	• 거리 : 약 4km • 택시요금 : 약 2,000~2,500원 정도 • 시내버스 : 기본요금(신탄진, 부강, 척산, 미평행)
철 도	경부선 호남선 충북선	조치원역 조치원역 청주역	• 거리 : 약 15km • 조치원(청주역)앞에서 청주행 시내버스 및 좌석버스가 10~15분 간격으로 출발
개인차량	각 도 시	(고속도로-가능하면 청주I.C를 이용하시기 바랍니다.) 1. 청주I.C(좌회전) → 청주방향(직진) → 분평4거리(좌회전) → 개신5거리(좌회전) → 충대(직진) 2. 서청주I.C(중부고속도로, 좌회전) → 솔밭공원4거리(우회전) → 공단5거리(좌회전) → 충대4거리(우회전) → 충대(직진) 3. 청주I.C(경부고속도로) → 청주, 보은, 속리산 방향 → 공단5거리(직진) → 충대4거리(우회전) → 충대(직진)	

※ 참가비 납부방법

2008 춘계	사 전	당 일
일 반	6 만원	7 만원
학 생	4 만원	5 만원
비회원 일반	9 만원	10 만원
비회원 학생	6 만원	7 만원

- 학술대회 논문발표자는 반드시 학회 회원으로써 연회비 납부와 사전등록비를 각각 따로의 계좌번호 입금처리를 하여 주셔야만 하오니, 이점 착오 없으시길 바랍니다.
- 사전등록비 납부방법 : 국민은행 : 계좌번호 : 031-01-0420-215(예금주 : 대한의용생체공학회)
- 연회비 납부방법 : 국민은행 : 계좌번호 : 031-25-0006-795(예금주 : 대한의용생체공학회)

목 차 | 2008년도 대한의용생체공학회 춘계학술대회

Tutorial

좌장 | 정병조(연세대)

- Introduction to Biomedical Optics
  대구가톨릭대학교 | 윤종인

- Current technology and research trends in Biomedical Optics
  경북대학교 | 김지현

Introduction to Biomedical Optics

윤 종 인

대구가톨릭대학교 보건과학대학 의공학과

2008년 5월 9일

대한의용생체공학회 춘계학술대회

Outline

- Biomedical Optics Fundamentals
  - Definition and Importance of Biomedical Optics
  - Optics and Laser Fundamentals
  - Introduction to Tissue Optics
  - Laser-Tissue Interactions: Optical and Thermal events
- Clinical Applications in Biomedical Optics
  - Part I: Optical Diagnostic Application (Optical Coherence Tomography)
  - Part II: Laser Therapeutic Application (Laser Tissue Ablation)

Definition of Biomedical Optics

- *Biomedical optics is the use of optical techniques to diagnose and treat disease as well as to obtain new biological information*

Why Biomedical Optics is Promising?

- *Optical Diagnostic Applications:*
  - In vivo measurements with high spatial resolution
  - Non-invasive or minimally invasive measurements
  - Functional and structural information of tissue
  - Inexpensive and portable
- *Laser Therapeutic Applications:*
  - Non-ionizing treatment (unlike X-rays)
  - Localization
  - Minimal damage in surrounding tissue

The Future of Biomedical Optics

- Biomedical Optics is merging with other biomedical engineering society and it will be powerful area!!!

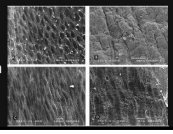
+ Nano-Technology

+ Bio-Technology

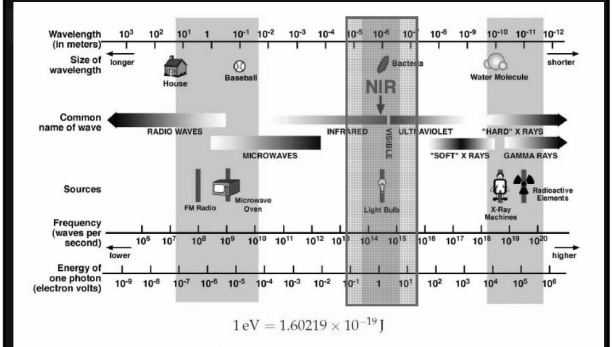
+ Cell and Tissue Engineering

Selective Laser Sintering

Laser Perforation



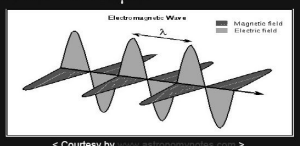
Electromagnetic Spectrum



< Courtesy by Advanced Light Source Inc. >

Property of Light

- Classical (wave) Description
  - Light is a transverse EM wave with wavelength 100nm < λ <10μm

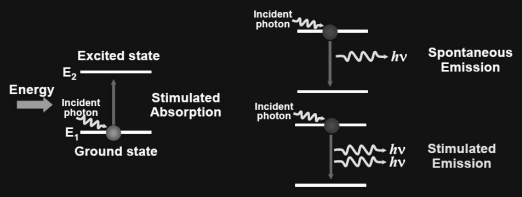


< Courtesy by www.astronomynotes.com >

- Quantum (particle) Description
  - Localized, massless qunata of energy → photon
  - $E_p = h\nu = hc/\lambda$, h = 6.626 X 10^{-34} Js

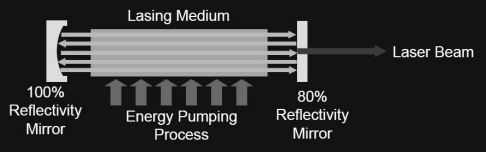
What is Laser?

LASER: Light Amplification by Stimulated Emission of Radiation



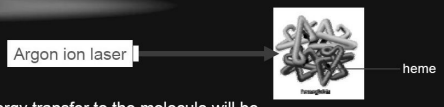
- **Photons by stimulated emission**
  - In phase, same λ, and same direction with the incident photon
  - Relatively long lifetime compared to photons by spontaneous emission

Laser elements and properties



- **Unique properties of laser light**
  - Coherence: All waves are in phase with one another at every point
  - Monochromaticity: Single color
  - Directionality: light travels in the same direction

Example: Heme absorption of photon

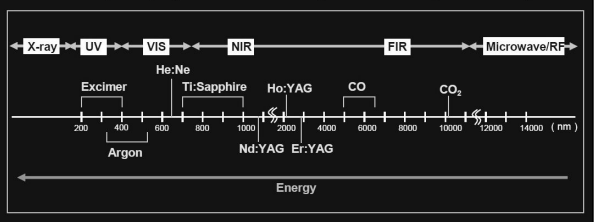


→ Energy transfer to the molecule will be,
$E = h\nu = hc/\lambda$ = 3.86*10^{-19} J ← Quite small amount of energy!!!

- However, the perspective of the absorbing chromophore!
  The photon is absorbed by the heme chromophore (~ 1nm) within the hemoglobin protein.
  → The Energy density (H) of the heme chromophore (V = (1 nm)^3) that absorbs one photon,
  $H = E/V = (3.86*10^{-19}\ J)/(10^{-7}\ cm)^3 = 387\ [J/cm^3]$

Spectrum of Medical Lasers

- Diagnostic and therapeutic applications
  → The optical properties of tissue vary with wavelength of laser light



Spectrum of commercially available lasers for medical applications

What is Tissue Optics?

- Definitions from dictionary
  - Optics: a science that deals with
    - genesis and propagation of light
    - changes that it undergoes and produces
  - Tissue: an aggregate of cells
    - usually of a particular kind together with their intercellular substance that form one of the structural materials of a plant or an animal

What is Tissue Optics?

Tissue + Optics = Tissue Optics

Subject of Interest Investigating Principle

We are interested in …

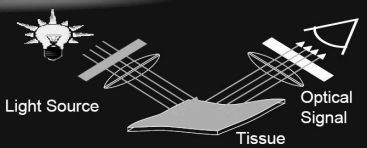
- Constituents of Tissue
- Optical Properties of Tissue
- Propagation of Light
- Interaction between Light and Tissue
- Diagnostic and Therapeutic Implications

Is Tissue Optics Special?

Three Major Components
- Optical Source – Sun
- Medium - Atmosphere
- Detector – Human Eyes

- Interaction between light and particles in atmosphere
  - Absorption
  - Scattering (Rayleigh & Mie)
- Propagation of Light through Atmosphere

Introduction to Tissue Optics

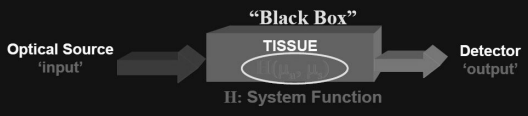


Optical Signals can probe…

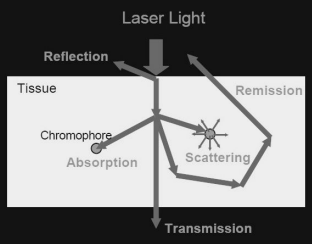
< Endogenous contrast >	< Exogenous contrast >
- Structural proteins - Hemoglobin saturation - Water/lipid content - Size and density of cellular components	- Photosensitizers - Molecular imaging using markers tagged with: - Cyanine dyes - Nanoparticles

Ultimate Goal of Tissue Optics

- Assess all optical properties non-invasive in living tissue (*in vivo*)
- Difficulties
  - Tissue is a complicated heterogeneous system
  - Requires meaningful information for diagnostic and therapeutic purposes



Laser-Tissue Interactions



Optical Properties are:
- Absorption coefficient [μ_a]
  :Probability of absorption
- Scattering coefficient [μ_s]
  :Probability of scattering
- Anisotropy coefficient [g]
  :Average cosine of angle scattering

Laser-Tissue Interactions

How are the optical properties obtained and used?

Measure %R and %T of biological tissue

Generate μ_a, μ_s, and g from Radiative Transport Equation depending on λ

$d = \frac{1}{\mu_a + (1-g)\mu_s}$

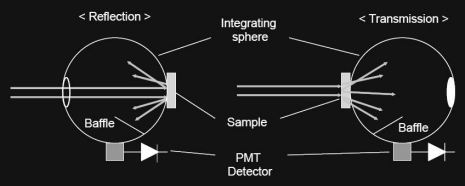
Spectroscopic analysis

:Determine penetration depth (d) of a laser light in tissue
➡ Optimize the choice of laser dosimetry to minimize thermal damage of tissue

➡ Provide a clue as to the chemical composition of a tissue. e.g.) Light absorption by blood → highly depends on wavelength and oxygenation

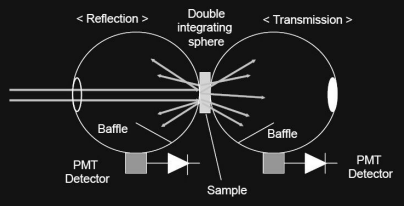
Optical Property Measurements

- Spectrophotometer with a single integrating sphere

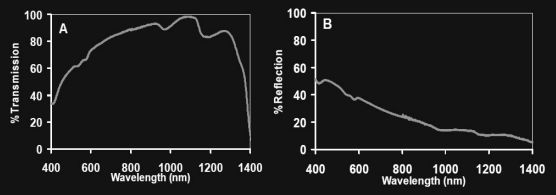


Optical Property Measurements

- Spectrophotometer with double integrating sphere

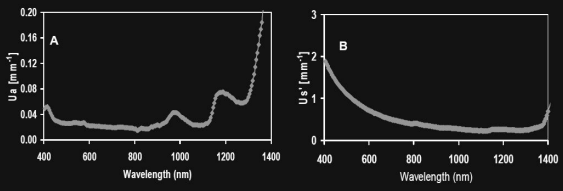


Optical Property Studies of Tissue



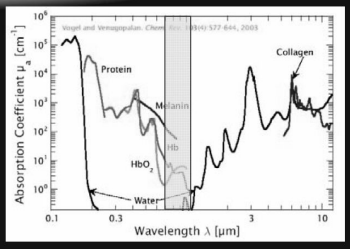
Transmittance (A) and Reflectance (B) spectra of cartilage sample in the 400 – 1400nm spectral region

Optical Property Studies of Tissue



- Absorption (A) and scattering (B) coefficients of cartilage in the 400 - 1400 nm spectral region using inverse adding - doubling algorithm

Absorption Spectra of Tissue



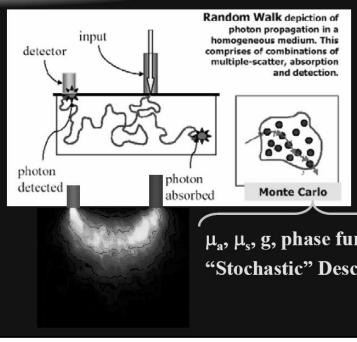
- **UV → Absorption increases due to protein, DNA, and other molecules**
- **IR → Absorption increases due to tissue water content (~75%)**
  → Minimal Absorption in the red to NIR: Diagnostic Window !!

Application of Optical Property Studies

- Measurement of breast tissue optical properties
  → Use the wavelength-dependence of absorption in tissue
  → hemoglobin concentration, oxygen concentration, etc.
  → Cancer detection
  - High absorption coefficient values and oxy-hemoglobin concentration in malignant tissue
- Measurement of aortic tissue optical properties
  → Spectral characteristics of diseased artery wall (plaque, or calcified) are significantly different from that of healthy vascular wall

Laser-Tissue Interactions

Optical Events: Modeling photon propagation

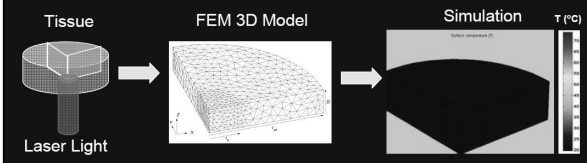


μ_a, μ_s, g, phase function S

"Stochastic" Description

Laser-Tissue Interactions

Thermal Events: Modeling heat propagation

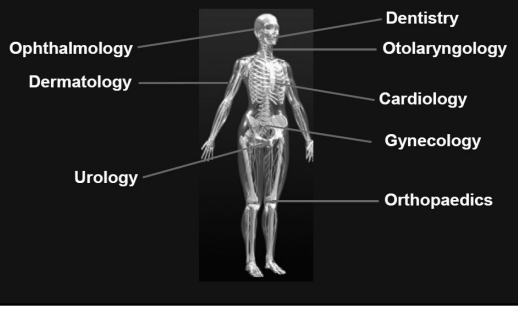


• Parameters for modeling:

- λ = 1.32 μm (Nd:YAG laser); exposure time = 10.0 sec; power = 4.0 W
- Thickness (cartilage) = 3.8 mm; diffusivity = 5.2 mW/cm^{0}C; conductivity = 1.38 $\times 10^{-3}$cm^2/s

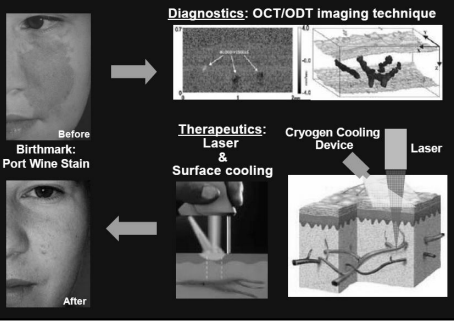
Clinical Applications in Biomedical Optics

Clinical Applications



Clinical Applications in Biomedical Optics

Example: Laser Treatment in Dermatology



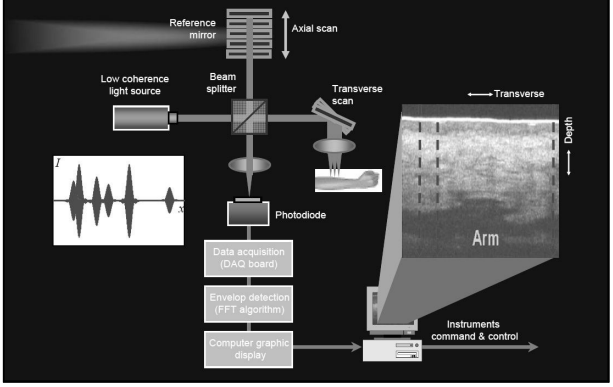
Optical Diagnostic Applications:

Optical Coherence Tomography

Comparison of Imaging Modalities

Imaging Technology	Typical resolution (um)	Imaging Depth (mm)	System Cost	Speed	Features
Microscopy	1	0.3	Low	Video rate	Non-Invasive
OCT	2-15	1.5	Low	Video rate	Non-Invasive
Ultrasound	150	150	Low	Video rate	Contact
MRI	1000	-	High	50ms	Non-Invasive
CT	1000	-	High	50ms	Non-Invasive, Radiation

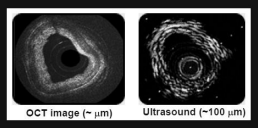
Optical Coherence Tomography



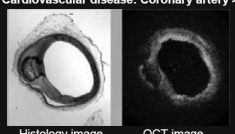
Optical Coherence Tomography

< Advantages >

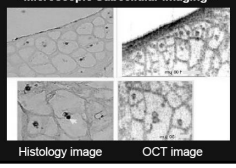
- High resolution: ~ μm
- Tissue characterization: Spectroscopic/ polarization imaging
- Small size: Fiber based design
- Real time imaging, In vivo



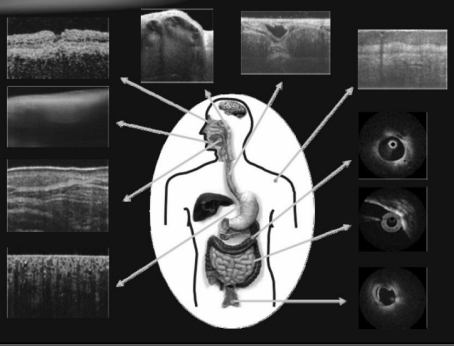
< Cardiovascular disease: Coronary artery >



< Microscopic Subcellular imaging >



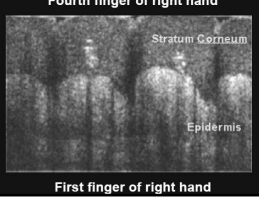
What can OCT image?



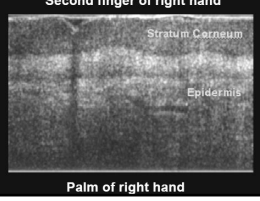
Fingers and Palm Image using OCT

Fourth finger of right hand

Second finger of right hand

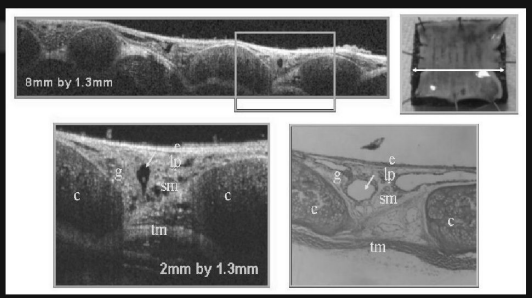


First finger of right hand



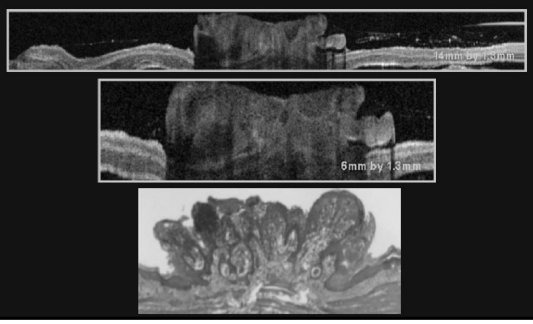
Palm of right hand

Rabbit Trachea using OCT

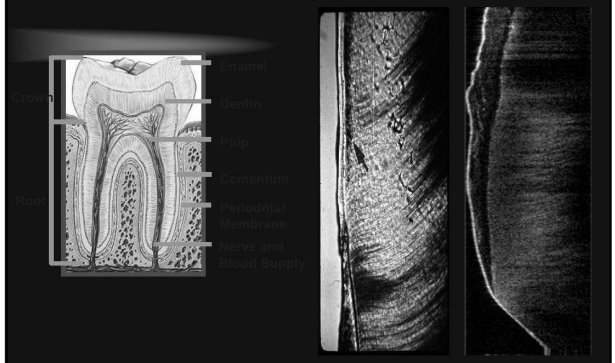


e is Epithelium, lp is the Lamina propria, g is the glands, c is cartilage, sm smooth muscle

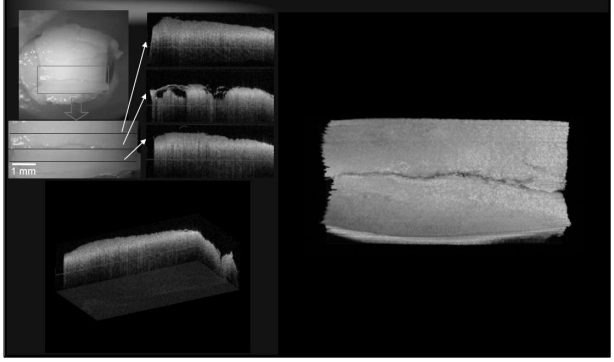
Hamster Cheek Pouch with Cancer



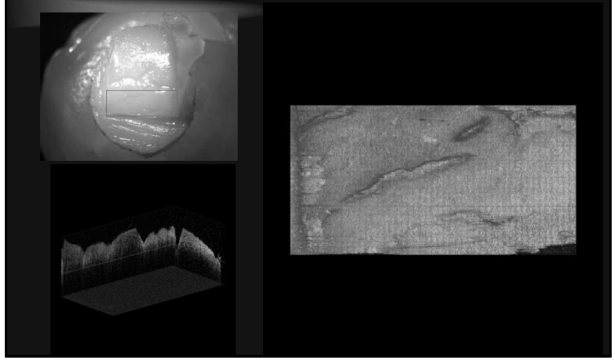
OCT in Dentistry



Osteoarthritis Diagnosis using 3-D OCT

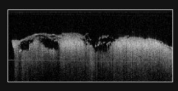


Osteoarthritis Diagnosis using 3-D OCT

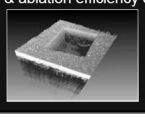


3-D OCT Application in Arthroscopy

- Arthroscope integrated with 3-D OCT system can provide…
  → Micro-structural surface topography
  → sub-surface feature visualization



→ Monitoring of treatment procedure
→ Volumetric observation of ablation crater & ablation efficiency evaluation

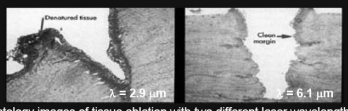


Laser Therapeutic Applications:

Tissue Ablation

Laser Therapeutic Applications
Tissue Ablation

- Important terms for tissue ablation
  - Ablation threshold: $\Phi = \rho h_{ablation} / \mu_a$
  - Thermal diffusion time: $t_d = 1/\kappa\mu_a^2$
  - [Thermal confinement: t_p (Laser pulse duration) < t_d]
- Tissue damage for ablation depends on
  - Tissue thermal and optical properties (μ_a, μ_s, κ; χ etc.)
  - Laser Power (P)
  - Laser pulse duration (t_p)
  - Laser wavelength (λ)



Histology images of tissue ablation with two different laser wavelengths

Laser Therapeutic Applications
Tissue Ablation: Pulse duration dependence

Long Pulsed Laser ($t_p > t_d$)

Chromophore Absorption → High energy needed

Thermal confinement failed
→ Strong thermal conduction
→ Mechanical shock wave propagation before end of the long pulse

Tissue

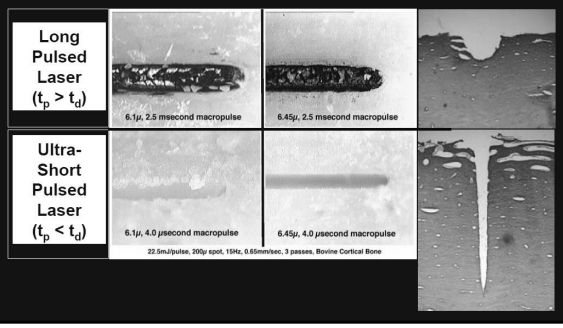
Ultra Short-Pulsed Laser ($t_p < t_d$)

Electron absorption: Fast plasma expansion → Low energy needed

Thermal confinement achieved
→ Low thermal/mechanical damage
→ Fast ejection of high temp. plasma

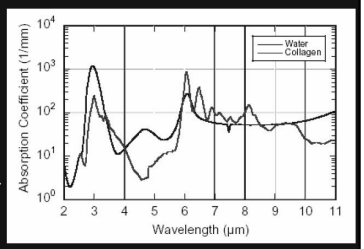
Tissue

Laser Therapeutic Applications
Tissue Ablation: Pulse duration dependence



Laser Therapeutic Applications
Tissue Ablation: Wavelength Dependence

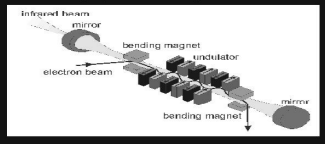
- Protein IR absorption peaks at 6.1, 6.45, and 8.3 μm due to amide excitation
- Water absorption peak at 0.96, 1.44, 1.95, 2.94 and 6.1μm

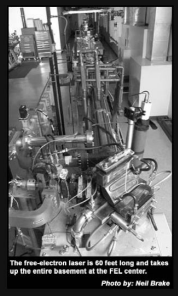


Laser Therapeutic Applications
Tissue Ablation: Wavelength Dependence

• Free Electron Laser (FEL):
- Only ten in the world now (U.S.(5), Japan(2), Italy(1), Netherlands(1), France(1))
- Broadly Tunable wavelength laser
- Ultra short pulsed laser
  (FEL in Vanderbilt Univ.: λ = 2 ~ 10 μm, t_p = 1 ps)

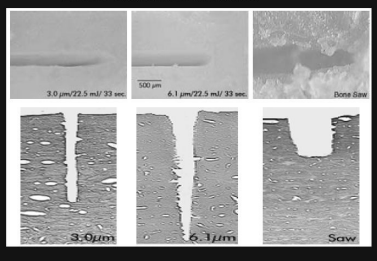
→ Preliminary studies for new lasers
→ Microsurgery: Brain and Eye

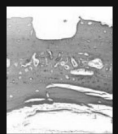



The free-electron laser is 60 feet long and takes up the entire basement at the FEL center.
Photo by: Neil Brake

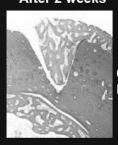
Laser Therapeutic Applications
Tissue Ablation: Wavelength Dependence

Bone ablation studies



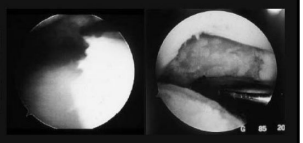

Saw

After 2 weeks

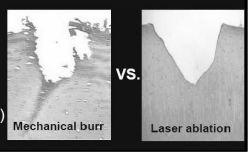

6.1 μm laser

Laser Therapeutics of Cartilage

- Current Surgical Techniques

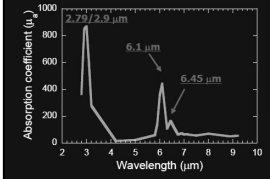


- Surgical Challenges
  - > Tissue roughness, no precise control, damage to healthy tissue…
- Laser Tissue Ablations
  - > Clinical efficiency (speed of tissue removal)
  - > Low thermal injury (rapid healing process)
  - > Minimally invasive (waveguides)
  - > Precise control (minimize surrounding tissue)

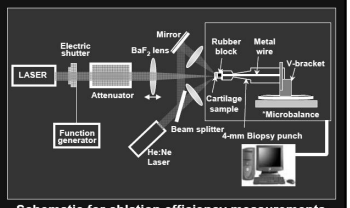


Ablation Efficiency Measurements

- The wavelengths examined:
  - > 2.79/2.9 μm (water absorption)
  - > 6.1 μm (protein/water absorption)
  - > 6.45 μm (protein absorption)



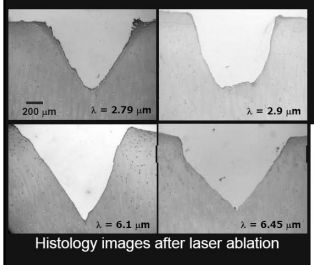
Optical property of cartilage measured by FT-IR spectrometer



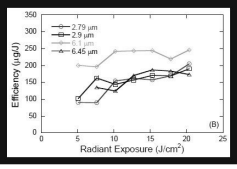
Schematic for ablation efficiency measurements

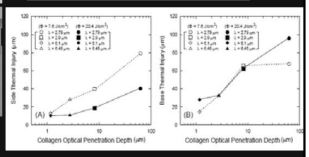
*Microbalance - Resolution = 10 μg
- Data Acquisition rep. rate = 5 Hz
- Function generator: Control laser exposure time

Wavelength Dependence Study of Cartilage Ablation



Histology images after laser ablation





*Youn *et al.* Lasers Surg Med, 36:202-209, 2005
Youn *et al.* Lasers Surg Med. 38:218-228, 2006

의광학 기술 및 산업동향

김지현
경북대학교

목 차

본 발표의 내용은 한국광기술원에서 출판한 2007 바이오 광응용 기술 해외 마케팅 로드맵의 내용을 참조하였음

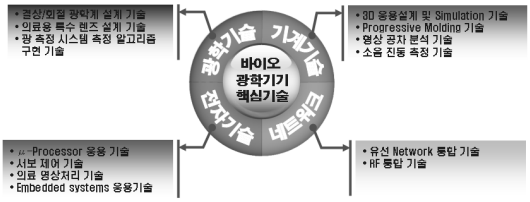
2

1. 바이오 광 기술의 개요

바이오 광 기술이란?

생체에 대한 광학적 작용을 응용한 기술을 의미(Biomedical optics)
넓은 의미에서는 광기술을 이용한 바이오 산업을 가리킴

- 바이오광 이미징 기기(Biophotonics Imaging Product)
- 바이오광용 광원 기기(Biophotonics Light Source Product)
- 바이오광 응용 기기(Biophotonics Applications Product)



3

1. 바이오 광 기술의 개요

바이오 광 기술의 필요성

○ 바이오 광기기가 다른 의료기기와 구분되는 특징

- 기술적 난이도가 높아 의료선진국에서 차세대 전략산업으로 추진 중
- 바이오 광기기는 대부분 국내 기술 역량으로도 충분히 접근 가능
- 안과용 OCT등은 time-to-market이 적용되는 분야로 시기 적절
- 광학영상의 경우 선진국과의 기술격차를 줄이기 좋은 분야임

○ 바이오 광기기와 광산업과의 연계성

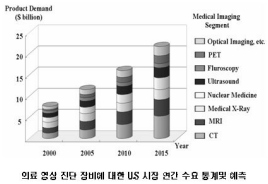
- 중앙 및 지방정부에서 추진중인 광산업 분야와 의료 바이오 분야를 접목, 국내 산업시장 선점 가능
- 광산업의 지속적인 발전 연계를 위해 신 융합산업인 광 의료기기 산업을 통한 국내외 시장 선점이 국가 경쟁력 확보를 위한 초석이 됨

4

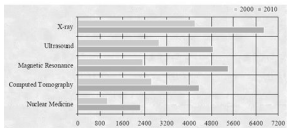
2. 바이오 광 산업 동향

바이오 광 이미징 분야

- 의료 서비스는 발병 조기 질병을 정확히 진단/저방하여 완치 성공률을 극대화하는 방향으로 발전하는 추세
- 첨단 의료영상 진단 기술은 U.S시장의 경우 2015년 220억불에 이를 것으로 예상
- 향후 진단장비의 경우 친 인간적, 친 환경적인 새로운 의료영상 기술이 향후 각광받을 것으로 예상
- 미국은 분자 영상 기술 분야를 21세기 10대 산업의 하나로 선정, 2001년 부터 관련법 제정 후 국립 생의학 영상 및 생체 공학 연구소(NIBIB)를 설립해 분자영상 시장 선점을 위한 집중적인 투자



의료 영상 진단 장비에 대한 US 시장 연간 수요 통계및 예측
(2000-2015, Source : The Freedonia Group Inc.)



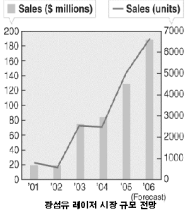
의료 영상 진단 장비에 대한 세계 시장 전망
(Medical Imaging Equipment Services-
A Global Strategic Business Report 2005.10)

5

2. 바이오 광 산업 동향

바이오 광원 분야

- 전세계 의료용 레이저기기 시장은 연평균 26 % 이상의 고성장률을 나타내고 있으며 2007년에는 177억 달러를 상회하는 큰 시장을 형성할 것으로 전망
- 국내 의료용 레이저 기기 내수 시장은 2002년 617억원으로 전년대비 약 27.9 %의 성장률을 나타냈으나 2003년에는 전반적인 경기 침체로 342억의 내수시장을 기록



광섬유 레이저 시장 규모 전망
(IPG Photonics 06)

- 그러나 향후 노령인구 증가와 더불어 의료용 레이저 수요가 늘어날 것으로 보여 매년 12 % 의 내수 증가가 예상 (의료용 레이저 기기 시장 동향, EIC 2005)
- Strategies Unliminted (SU) 에 따르면, 2010년까지 광섬유 레이저는 28억 달러에 이르는 산업용 레이저 시장의 1/4을 점유할 것으로 전망
- 광섬유 레이저 판매는 연간 28억 달러로 불과 9 % 씩 성장해온 산업용 레이저 시장에 비해서 2005년 1억 4천만 달러에서 2010년 6억 8천만 달러로 연간 35 % 이상의 성장이 기대됨

6

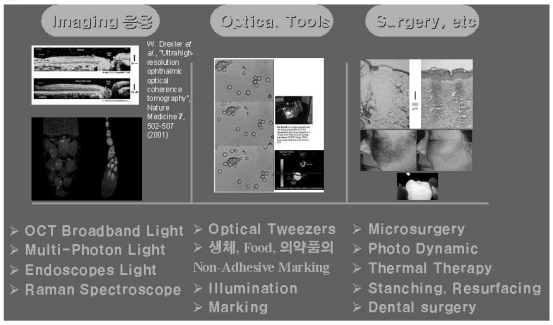
2. 바이오 광 산업동향

바이오 광 의료용 광원을 이용한 여러 응용분야

7

바이오 광 산업 동향

핵심 광원(Light Source) 및 이미징 응용을 통한 바이오 의료 응용 분야



8

3. Optical Coherence Tomography (OCT)

● 정의

▸ 광의 간섭현상을 이용하여 생체 내부 미세조직 영상을 비침습적으로 획득 할 수 있는 광학적 이미징 기법으로 고해상의 단층 영상 취득이 가능

● 작동원리

▸ 저가간섭 또는 백색광 간섭계의 원리와 공초점 현미경 방식의 조합으로 피부조직 내부의 미세구조를 획득, 기본적인 OCT 시스템은 시간 가간섭성이 매우 짧은 광원을 이용한 마이켈슨 간섭계로 구성

● 시장성 및 성장성

▸ 생명 연장에 대한 요구의 증가로 인하여 질병의 조기 진단 및 치료를 위한 정밀 진단에 대한 필요성 급속도로 증가
▸ 초음파나 CT, MRI와 같은 기존 방법들은 유해성, 경제성, 해상도, 이미지 취득시간에 문제로 그 효용성이 제한됨
▸ 경제적이고 인체에 무해하며 고해상 단층영상을 실시간으로 조영할 수 있는 OCT는 이들 조건을 충족해주는 기술로써 그에 대한 수요는 지속적으로 증가될 것이라 예상

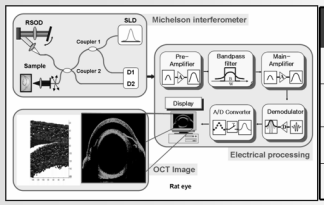
ZEISS사의 Visante-OCT

OTI사의 OCT/SLO

9

○ Optical Coherence Tomography (OCT)

● 짧은 가간섭 거리 (low coherence length) 를 가지는 광대역 광원을 사용해 비침습적으로 생체 내 부조직의 단층 영상을 얻을 수 있는 광학 생체 조영기술
● 기존의 단층 촬영 기술이 줄 수 없는 서브 마이크로 단위의 고해상도의 미세구조 영상을 제공



Time-domain OCT 시스템 구성도

의료영상기술	해상도 (μm)	영상깊이 (mm)
OCT	1 ~ 10	2 ~ 3
초음파 영상 기술	200 ~ 300	150
MRI	100 이하	제한 없음
CT	100 이하	제한 없음

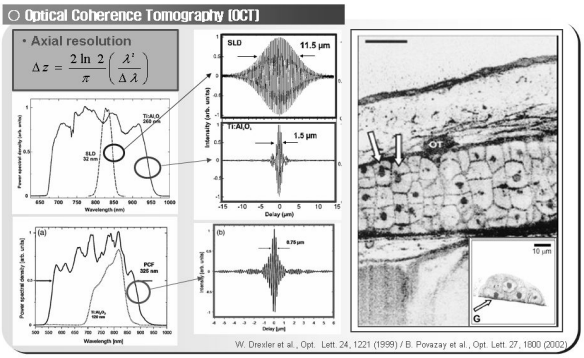
OCT 와 기존 촬영기술의 해상도 및 영상깊이 비교

10

○ Optical Coherence Tomography (OCT)

• Axial resolution

$$\Delta z = \frac{2\ln 2}{\pi}\left(\frac{\lambda^2}{\Delta\lambda}\right)$$



W. Drexler et al., Opt. Lett. 24, 1221 (1999) / B. Povazay et al., Opt. Lett. 27, 1800 (2002)

11

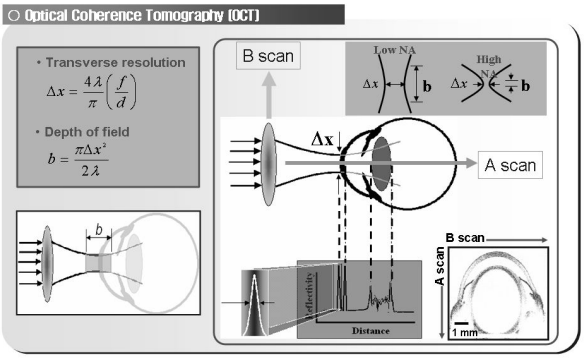
○ Optical Coherence Tomography (OCT)

• Transverse resolution

$$\Delta x = \frac{4\lambda}{\pi}\left(\frac{f}{d}\right)$$

• Depth of field

$$b = \frac{\pi\Delta x^2}{2\lambda}$$



12

세계 우수 OCT 제품 사양

제품 모델명(제조사)	규 격		비 고
Stratus OCT™ (Carl Zeiss)	시스템 타입	SD OCT	초자체 망막 질병 이나 녹내장에 대한 단층 이미징후 망막구조의 정량적 분석이 실시간으로 가능
	축상 해상도	≤ 10 μm in tissue	
	측상 해상도	≤ 20 μm in tissue	
	광학 파워	≤ 750 μW at cornea	
	스캔 깊이	2 mm in tissues	
SD OCT Retinal imaging system (Bioptigen)	시스템 타입	SD OCT	안구내부 단층 정보 제공
	축상 해상도	≤ 6 μm in tissue	
	측상 해상도	≤ 20 μm in tissue	
	광학 파워	≤ 750 μW at cornea	
	스캔 깊이	2.2 mm in tissues	
OTI OCT/SLO (OTI)	시스템 타입	SD OCT/SLO	Scanning Laser Ophthalmoscope (SLO) 의 공초점 이미징 원리와 OCT 의 단층 촬영 원리의 복합적 구성으로 안구 기저부위의 표면 영상 이미지를 고해상도로 구현 가능
	축상 해상도	≤ 5 ~ 6 μm in tissue	
	측상 해상도	≤ 15 μm in tissue	
	광학 파워	≤ 750 μW at cornea	
	스캔 깊이	1.7 ~ 2.3 mm in tissues	

13

4. OCT용 Super-luminescent Diode (SLD)

● 정의

- Edge-emitting 반도체 다이오드의 한 종류로써, 반도체 pn 접합부에서 분포반전(population inversion)에 의한 자발 방출 과정을 통해 빛을 발생시키는 광원

● 소요기술 및 기술적 특징

- 근적외선 파장대역 광출력 기술
  - 최적의 OCT 이미징 파장대역 (1.3 μm ~ 1.65 μm) 광출력 발생
- 광대역 스펙트럼 기술
  - 고해상도 OCT 이미지 획득을 위한 광대역 스펙트럼 광원이 필요
- 광원의 시스템 안정성 기술
  - 파워의 항상성과 외부환경에 안정적으로 동작 가능한 광원이 필요

● 시장성 및 성장성

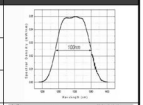
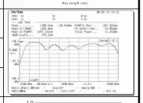
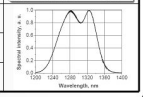
- 최근 OCT 의 지속적인 수요 증가로 인해 OCT 광원으로서의 SLD 시장규모는 확대될 전망임
- 현재 국내 시장에 공급되는 광대역 SLD 광원은 대부분 수입에 의존, 반도체 산업 강국으로서 광대역 SLD 광원 기술 개발에 투자한다면 충분히 빠른 시장진입이 가능할 것으로 예상됨

Superlum 사의 Broadlighter SLD

Amonics 사의 Multi-Band SLD

14

세계 우수 SLD 제품 사양

제품 모델명(제조사)	규 격		스펙트럼 모양
BWC-SLD (BWTEK Inc.)	Peak wavelength	1310+/-20 nm	
	Power in SMF	5 ~ 7 mW	
	FWHM	> 100 nm	
ASLD-CWDM (Amonics)	Peak wavelength	1310 nm	
	Power in SMF	Min. 10 mW	
	FWHM	281 nm	
D1550-LP (Superlumdiodes)	Peak wavelength	1300 nm	
	Power in SMF	5 mW	
	FWHM	85 nm	

15

파장 가변형 레이저

● 정의

- 60 nm 이상의 대역폭을 가지며 수 백 Hz에서 수 십 kHz의 속도로 시간에 따라서 다른 파장의 빛을 만들어 냄
- 광 통신 시스템의 연구 개발 단계 및 광통신 소자의 특성 측정, 광 센서, 바이오 메디컬 등 광 관련 개발에 필요한 핵심 소자로 다양한 분야에서 활용

Thorlabs, SL1325-P16

● 작동원리

- Stimulated emission을 발생시키는 Gain medium과 출력 증폭을 위한 lasing cavity로 나뉨
- Lasing cavity에 파장 선택을 위한 필터가 존재하고 파장을 가변할 수 있는 다양한 방법이 있음
- 파장 선택 및 가변용 필터로는 대표적인 Fabry-Perot Tunable filter와 Grating을 이용한 filter가 있음

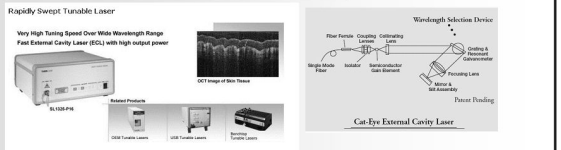
● 시장성 및 성장성

- 광통신 시스템에서 그 응용 분야가 biomedical 영역으로 확대됨에 따라 파장가변형 레이저의 수요는 꾸준히 증가할 것으로 예상
- 고속 파장가변형 레이저 수요 증가로 연간 시장 규모가 2조원에 달함
- 국내시장에 공급되고 있는 고속 파장가변형 레이저는 전량 수입에 의존

16

세계 우수 파장 가변 레이저 제품

○ Thorlabs SL1325-P16



○ Santec

HSL-200 TSL-210H

17

5. CARS Microscopy

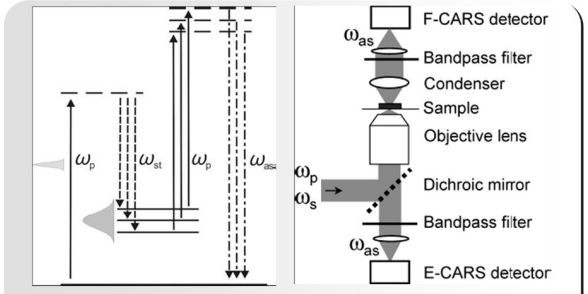
● 정의

- 분자고유진동 신호에 대응하는 화학적으로 선택적인 영상을 얻을 수 있는 영상장비
- 광학적 분광기와 현미경을 결합한 시스템으로 생물학이나 의학 분야에서 세포, 핵산, 단백질 등으로부터 높은 공간분해능을 가진 3차원 영상을 직접적이고 비 침습적인 방법으로 얻을 수 있는 최신 영상장비
- 검출 모드, 주사방식, 영상획득 을에 따라 전방 검출방식, 후방 검출방식, 레이저 스캐닝방식, 시분해 방식등과 같은 몇 가지로 분류됨

● 작동원리

- CARS는 비선형 광학현상에 기초한 라만 영상기법
- 피코초의 짧은 펄스를 가진 근 적외선 영역의 펌프레이저 빔과 stokes 레이저 빔이 샘플에 정밀하게 포커스되고, 입사 빔들과 샘플의 상호작용에 의해 입사 빔의 에너지보다 더 큰 에너지를 갖는 3차 비선형 신호가 발생됨
- 펌프 field와 stokes field 사이의 주파수 차이, $\omega_p - \omega_s$가 샘플의 라만 활성 분자 진동수와 등조될 때, 진동수, $\omega_{as} = 2\omega_p - \omega_s$에서 공명에 의해 강화된 anti-stokes 시그날이 발생됨
- ARS영상은 샘플이나 레이저 빔을 raster 스캔 함으로서 획득되고 3차원의 영상이 구현됨

18



CARS 에너지 diagram (a)과 장치 개략도(b)

19

● 특징

- CARS 현미경에서, vibrational contrast는 $\omega_1 - \omega_2$가 라만활성 진동모드와 동조될 때 시그날 강화로부터 일어나며, CARS 강도는 펌프 field강도의 제곱에 비례하고, stokes field 강도에는 선형으로 비례하기 때문에 시그날은 중심초점영역의 좁은 볼륨(< 1um³)에서만 발생하고, 3차원 sectioning이 가능한 또한, 비교적 큰 샘플로부터 CARS field의 가 간섭적 보강은 낮은 여기파워와 빠른 주사율을 허용하는 큰 방향성 시그날을 야기함

● 장점

- 첫째, CARS는 가간섭 프로세스이기 때문에, anti-stokes radiation의 보강간섭이 신호를 크게 강화시킬 뿐 아니라 샘플에 대해 방향성을 부여할 수 있어 신호의 콜렉션 효율을 크게 높일 수 있음
- 둘째, 신호 진동수가 여기 진동수보다 높아서 photon에 의해 여기된 형광의 영향하에서도 CARS 신호가 검출될 수 있음
- 셋째, 높은 공간 분해능과 함께 두꺼운 시료의 3차원 sectioning이 가능
- 넷째, 화학적, 생물학적 시료로부터 고도의 화학적 선택 성을 갖는 영상을 얻을 수 있음

● 단점

- 첫째, 고유의 약한 비선형 분극률로 인하여 높은 첨두파워를 가진 레이저 광원을 요구함
- 둘째, 관심 물체와 주위의 솔벤트로부터 nonresonant background가 이미지 콘트라스트와 스펙트라 선택성을 제한함
- Ultrafast 레이저 광원의 개발과 nonresonant background를 억제할 수 있는 기법들의 개발로 이러한 난점들이 해결되어 옴

20

● 소요기술 및 기술적 특징

- 가시광선영역의 레이저는 비 공명 background신호를 강화시키기 때문에 signal-to-background 신호를 감소시키기 위해 펄프와 stokes 광원으로써 근적외선영역의 레이저를 사용하는 것이 바람직하고 높은 펄스에너지를 갖는 레이저의 사용은 샘플에 손상을 줄 수 있기 때문에 레이저의 펄스에너지는 낮아야 함 그러므로 피코초의 펄스폭과 80 Mhz의 repetition rate를 갖는 근 적외선영역의 Ti:sapphire레이저가 CARS영상을 위한 레이저 광원으로 주로 이용
- CARS는 기본적으로 시료의 화학적 특성인 라만밴드에 대응하여 영상을 구현하는 기술이기 때문에 가능한 넓은 라만대역에서 영상을 얻는 것이 바람직하고 이를 위해 넓은 파장대역에서 파장가변이 가능한 펄스레이저가 요구됨
- 실시간으로 고속 CARS 영상을 획득할 수 있는 기술개발이 필요하며, 최근에 multiplex CARS microscope의 개발로 빠른 이미지 획득이 가능해 졌음

● 응용 및 연구동향

- 고도의 화학적 선택성이 요구되어지는 다양한 화학적, 생물학적 이미징 분야에 활용되고 있음 특히, 최근의 연구는 주로 세포생물학, 암 연구, 바이오 의약 등과 같은 의학 및 생물학 분야에 집중되고 있음
- 최근 연구동향은 실시간 모니터링이 가능한 초고속 이미징을 구현하는데 초점이 맞춰져 있으며, 공초점 형광현미경, 다 광자 공 초점 레이저 현미경 등과 같은 광학현미경과의 결합시스템을 구성하려는 시도들이 진행되고 있음
- 의학 분야의 진단영상에 활용하기 위한 CARS 내시경의 개발이 시도되고 있으며, 싱글모드 광섬유를 적용한 원시타입의 CARS endoscope가 보고된 바 있음

21

6. Multi-photon Scanning Confocal Microscopy

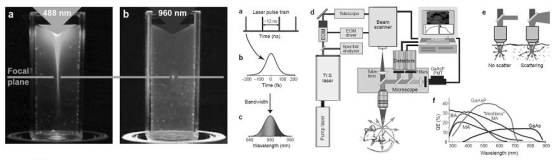
● 정의

- 다광자 공초점 주사현미경(MPM)은 기본적으로 얇은 점 주사(raster-scanned)면에서만 선택적으로 형광을 유도하는 국부적인 비선형 여기현상을 이용함 약 10 여 년 전에 코넬대학의 Zipfel 그룹에 의해 최초로 개발된 이래, 다광자 공초점 주사현미경은 다양한 영역에서 형광영상기술로 활용되어 왔으며, 현재는 두꺼운 조직과 살아있는 조직 및 생체의 형광영상기술로 자리매김 하였음

● 작동원리

- Two-photon microscopy(TPM)는 같은 레이저로부터 거의 같은 에너지를 가진 두 개의 광자가 분자와 상호작용하여 2 배의 에너지를 가진 단일광자의 흡수에 의해 야기된 여기와 동등한 여기를 생성한다는 Mayer의 이론에 기초함
- 이러한 프로세스에서 두 개의 광자는 거의 동시(~ 10^{-18} sec)에 분자와 상호작용하고 발생확률은 단일광자 흡수에 의한 통상적인 형광의 경우 입사광의 강도에 선형적으로 비례하는데 반하여 입사광의 강도의 제곱에 비례
- 입사광의 세기에 대한 제곱 종속성은 MPM 프로세스의 국부적인 발생의 원인을 제공함
- 이미지는 레이저가 샘플을 가로질러 스위핑 (sweeping)함에 따라 생성되는 검출기 신호를 디지털화함으로써 만들어진 형광강도의 메트릭스 (matrix)로 구성

22



(a) 단일광자 여기와 (b) 두 광자 여기

〈다광자 공초점 주사 현미경의 전형적인 모식도〉

(a)는 80 MHz의 repetition rate를 가진 mode-locked Ti:sapphire로 부터의 레이저 펄스 열(pulse train)을 나타내고, (b)는 레이저 펄스들이 전형적으로 100 fs의 FWHM 지속시간(duration)과 (c) 약 10 nm의 분광폭(spectral bandwidth)을 가짐을 나타냄 (d)는 MPM 시스템의 조직도를 나타내고, (e)는 시료 내의 깊은 초점으로부터 발생된 빛이 산란되어 발산성의 형광을 야기하면서 비스듬하게 대물렌즈로 입사할 수 있음을 보여줌 (f)는 PMT 검출기들의 광 음극 효율의 비교스펙트럼을 보여줌 대부분의 MPM은 근 적외선 펄스레이저를 반사시킬 수 있도록 채택된 레이저 스캐닝 confocal과 주변장치들로 구성

23

● 장점

- 초점면의 국부적인 여기
- 초점면에 제한된 MPE에 기인한 out-of-focus 영역의 광표백 및 광독성의 완화
- 적외선 광원의 이용과 함께 형광이 초점 면에서만 일어나기 때문에 두꺼운 시료로부터 3차원 형광 영상을 얻을 수 있음
- TPE 프로세스 하에서 자외선 밴드가 강화되기 때문에, 동일한 레이저를 이용하여 서로 다른 형광체들을 동시에 여기 시킴으로써 multi-color 이미징이 가능하고, 색 수차를 피할 수 있음

● 소요기술 및 기술적 특징

- 여기 광원은 Nd:YVO4 pump laser와 Ti:Sapphire laser로 구성된 한 쌍의 레이저나 펄프레이저와 oscillator가 패키지 형태로 되어 있는 박스 타입의 레이저가 주로 이용되며, 80MHz의 repetition rate와 100fs의 펄스 duration을 갖는 펄스레이저가 주류를 이룸
- 주변기기는 레이저 빔의 강도조절을 위한 modulator, 빔의 크기를 조절하기 위한 빔 telescope, 빔 스캐너 및 검출기로 구성

● 응용 및 연구동향

- 두꺼운 조직과 살아있는 조직 및 생체의 3차원 형광영상을 위한 새로운 기술로 부각되고 있음
- 연구보고서의 약 절반이상은 특정 생물학적 연구보다는 기술과 장비의 개발에 더 역점을 두고 있음
- BioRad, Leica, Zeiss등으로부터 상업용 제품이 출시되고 있으나, 현재 까지는 공초점 주사현미경을 개조한 laboratory-built 시스템이 더 많이 활용됨

24

7. Second Harmonic Generation (SHG) Microscopy

● 정의

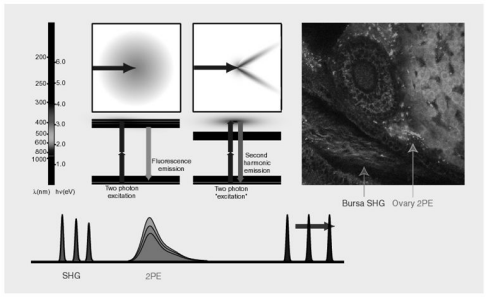
- SHG microscopy는 비선형 광학현상을 이용함으로써 외인성 표지 없이 다 광자 형광 현미경을 포함한 형광현미경에서 통상적으로 발생하는 광표백이나 광 독성 현상을 야기하지 않고 3차원의 고분해 영상을 얻을 수 있는 새로운 이미징 기술

● 작동원리

- 2차 하모닉 현미경은 강한 레이저 빔이 비 중심대칭의 분자기관을 가진 고도로 polarizable한 물질을 통과할 때 2차 하모닉 발생으로 알려진 비선형 광학현상에 기초함
- 두 광자 공초점 여기 현상과 달리 입사광의 흡수 없이 정확히 입사광의 파장의 ½의 2차 조화파를 발생
- 여기상태의 완화동안 입사에너지의 일부가 손실되는 TPE과정과 상이하게 여기상태를 포함하지 않고 에너지가 전환될 뿐 아니라 입사 빔의 가 간섭성을 그대로 유지함

● 장점

- SHG는 분자들의 여기를 야기하지 않기 때문에 원리적으로 TPM을 포함한 형광현미경에서 결점으로 인식되어온 광독성이나 광표백효과로부터 자유로울 수 있음
- 많은 고유구조들은 강한 SHG를 생성하기 때문에, 외인성 분자 프로브 (ex, 형광단백질)를 이용한 표지나 confocal이 필요치 않음
- 형광분자들을 여기 시키지 않고 3차원 이미지를 획득할 수 있는 유망한 영상기술임



두 광자 여기와 2차 하모닉 발생의 비교 및 이미지

● 소요기술 및 기술적 특징

- 입사광자당 SHG 시그날 파워는 MPM에 비해 훨씬 작기 때문에 collection과 detection 효율을 최적화 해주는 것이 중요함
- SHG 이미징은 편광분석을 통해 분자의 대칭성을 결정할 수 있음
- 편광분석은 Glan Laser Polarizer를 이용해 만들어질 수 있고 데이터는 입사레이저와 동일한 편광을 유지하면서 레이저 편광과 수직 및 수평하게 방향 지워진 analyzing polarizer를 이용해 이미지를 획득함으로써 얻어질 수 있음

● 응용 및 연구동향

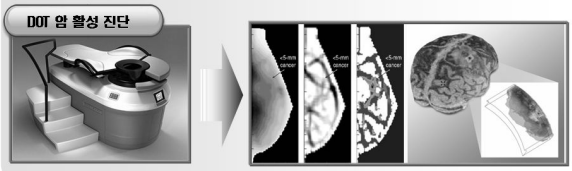
- 현대적 이미징 시스템을 갖춘 SHG 현미경은 1998년 Gauderon 등에 의해 개발되어 생물학 분야에 이용되기 시작하였음
- 최근의 생물학적 응용은 SHG의 polarization anisotropy를 이용하여 근육섬유질의 구조분석 등에 활용되고 있음
- 최근의 연구결과는 SHG가 질병상태를 감지하거나 건강한 조직과 병든 조직을 구분하는 프로브 기능을 할 수 있는 가능성을 보여줌
- 현재 활용되고 있는 대부분의 시스템은 공초점 주사현미경이나 다 광자 공초점 주사현미경을 변형한 형태이고, 분해능을 높이기 위해 근접장 현미경과 접목하여 활용하려는 시도가 진행되고 있음

8. Diffused Optical Tomography (DOT)

● 정의

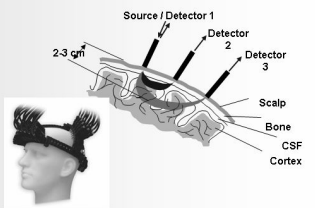
- 근적외선 생체 분광 기법을 응용하여 생체 병변의 크기나 위치, 활성정도를 2차원 또는 3차원 영상으로 나타내주는 이미징 기법
- 비침습적 방법의 생체조직 영상화, 방사능 피폭 배제 가능, 저가격의 다양한 생체정보 제공의 장점
- 현재 연구되고 있는 DOT 시스템에는 CW(continous-wave), TD(time-domain), FD(frequency-domain)이 있음

DOT 암 활성 진단



● 작동원리

- 광을 조직에 입사 시켜 조직 내에서 다중 산란되어 나오는 광자를 위치에 따라 측정
- 측정된 빛으로부터 조직의 광학적 특성을 결정하여 대응시킴으로써 영상을 구성하는 진단 장비대사 변화 등 인체의 반응에 민감하고 비전리 방사선을 이용하여 비침습적으로 진단을 하며 비교적 빠른 기능적 영상



● 시장성

- 세계 시장 규모가 약 2.5조원 (2007년 기준) 으로 약 7 % 씩 성장
- 선진국들의 시장 점유율 약 88 % 차지
- 국내 시장 규모는 3,100억원 가량임

● 기술성

- 초보적 DOT 국내 원천 기술
- DOT 세계 원천 기술 확보 가능
- 집적화된 융합형 의료진단 시스템 개발 기술 확보 가능

● 국책성

- 진입장벽이 큰 기술 집약형 과제
- 국내 바이오센서 및 의료영상 장비 관련 산업의 성장으로 경제적 이득과 고용창출이 기대됨
- U-Health용 진단기기로써 미래 정보 국가 실현 가능


세계 우수 DOT 제품 (뇌기능 진단용)
○ ETG-7000 (Hitachi Medical Corp)
3×5プローブ
4×4プローブ
○ DYNOT (Dynamic Near Infrared Optical Tomography, Hitachi)
31


세계 우수 DOT 제품 (유방암 진단용)
○ CTLM (CT Laser Mammography, Imaging Diagnostics Systems Inc)
○ SoftScan (Advanced Research Technologies Inc)
32

특 강

PHOTONICS INDUSTRY *in* KOREA

May 9, 2008

Yong-Jin Shin, Ph.D.
Professor, Department of Physics, Chosun University
President, Gwangju Regional Innovation Agency
Laser Imaging Laboratory : www.chosun.ac.kr/~yjshin

Contents

What is Photonics Industry…

Definition of Photonics Industry

Photonics industry refers to all related industries of materials, parts, instruments and systems which make, control and apply the light.

Generation of Light	Control of Light	Use of Light
Making the source of light having a specific wavelength or energy excluding natural light	An area of refracts, transmits, converges disperses the source of light.	Applying and using the controlled light according to its application.
Light Source	Optics	Optical Communication Optical Information Optical Precision Optical Materials

Prospect of Photonics Industry

▷ **Photonics industry is technology-intensive advanced industry and has a great pervasive effect on its related industries. It is also applied to the various areas such as information, communication, precision apparatus, medical service and energy.**
Communication, Information, Precision Apparatus, Medical Service, Energy, Chemistry, Automobile

▷ **While the 20th century was the age of electron, the 21st century is that of photon.**
Photonics industry is the key to settle the environmental problem of information energy which is the key word of the industry in the 21st century and has the potential of continuous high growth.

▷ **Suiting the creation of small and medium industries and specialization of big enterprises**
- Big enterprises : optical record media, display
- Venture, small and medium industries : most of items suit production by order.

Importance of Photonics Industry

▷ **Photonics industry is the essential technical industry affecting most of industries.**

▷ **Base industry of superspeed information society in the 21st century**
Photonics industry performs the key roles of superspeed information communication. It is impossible to actualize the future information society without the development of photonics industry.

▷ **Advanced country type industry making the knowledge the source of development**
America and Japan occupy over 70% of the world market. Photonics industry is technology-intensive industry and evades the overseas transfer of its technology.

▷ **The 21st century type environmental friendly industry without the restriction of resource**
Photonics industry does not depend on the natural resource. It is the industry which can easily settle the energy and environmental problems.

▷ **Base Industry of National Defense and Scientific Development**

Characteristics of Photonics Industry

▷ **Photonics industry is technology-intensive scientific and technical industry emphasizing research and development.**

- *Photonics industry is the scientific industry based on the basic technology and high technical personnel.*

▷ **Industry suitable to venture, small and medium industries**

- *It requires production by order suitable to technical and industrial demands rather than the mass production of ordinary products.*

▷ **Having a great effect of regional concentration**

- *Synergy effect can be exerted only if R&D, pilot production, mass production and cultivation of manpower are gathered in a specific region.*

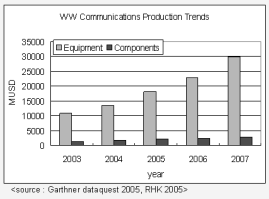
▷ **Complex industry which has wide range and variety of knowledge should be combined**

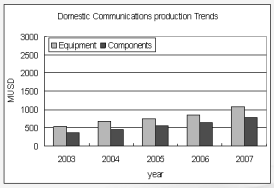
- *The basis of photonics industry is varied from the areas of natural science such as physics and chemistry to those of applied studies including electronic engineering, materials engineering and chemical engineering.*

Photonics Market Trends

WW & Domestic Production Trends

Optical Communication



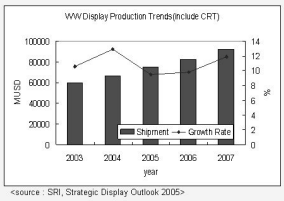


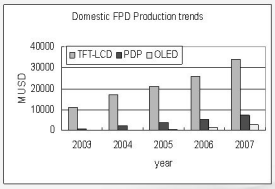
<source : Garthner dataquest 2005, RHK 2005>

- **Start Commercializing FTTH**
  - KT : XDSL/WDM-PON, 200,000user/2006 -> 1,750,000user/2009
  - ETRI : E-PON, "Development of FTTH service model Project" (20,000 user/ 05'-08')

WW & Domestic Production Trends

Display



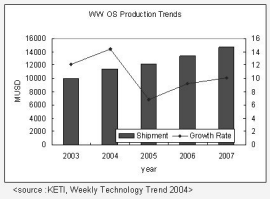


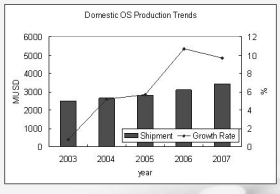
<source : SRI, Strategic Display Outlook 2005>

- **2005yr Domestic FPD Market Trends**
  - TFT-LCD 2.2B USD, OLED 464M USD, PDP 4,003M USD
- **Korean LCD maker : in spite of unstable market trends, continue large investment**
  - LG. Philips Displays, SAMSUNG SDI, etc

WW & Domestic Production Trends

Storage



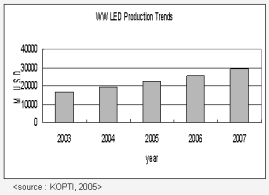


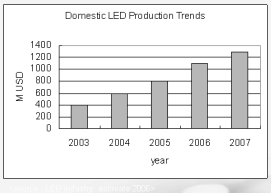
<source : KETI, Weekly Technology Trend 2004>

- **Domestic Expected OS Production 3,100 M USD in 2006**
  - After decline until 2003, continuously increase by DVD and DVD write
- **Diverting From CD to DVD and CD+DVD**

WW & Domestic Production Trends

LED



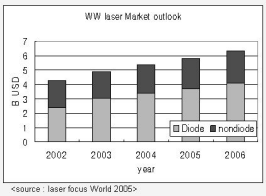


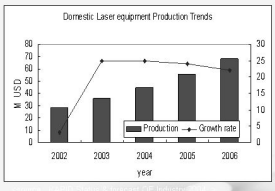
<source : KOPTI, 2005>

- **Acceleration R&D and other many activities for LED by Government**
  - Key-Technology Develop., Patent Group, Advisory Group, Generate new demand...
- **Construction LED Valley in Gwangju**
  - To generate domestic demand, LED Valley will be developed by using applications
  - LED Light, LED sign, LED traffic sign and etc with Solar Generator

WW & Domestic Production Trends

Laser



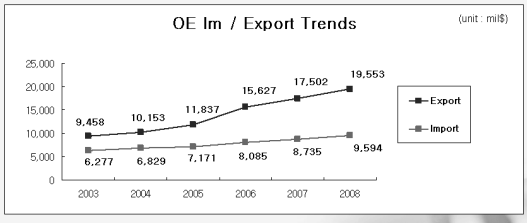


<source : laser focus World 2005>

- **Global laser Market turn up in 2003 after a three-year decline**
  - Expected 2006 sales will be gained 8 ~ 10%
  - Expected CAGR from 2005 will be about 12%
- **Semiconductor lasers were the growth engine**

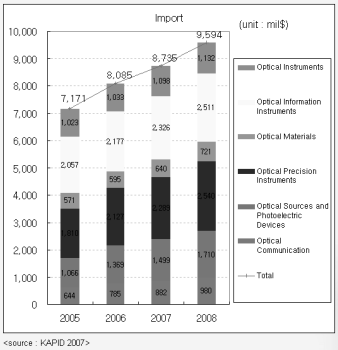
Market Trends

OE Im/Export



- **Domestic Scale of Im/Export related OE Industry Growth in general**
  - 2006 Export Scale grew about 32% (2005, 16%)

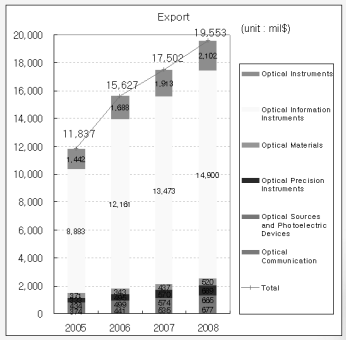
Market Trends



<source : KAPID 2007>

- **Import**
  - **Optical Information**
    Instrument ⇨ 27% (2006)
  - **Optical Precision**
    Instrument ⇨ 26% (2006)

Market Trends

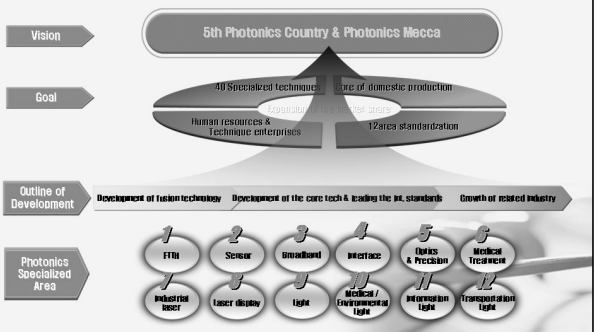


<source : KAPID 2007>

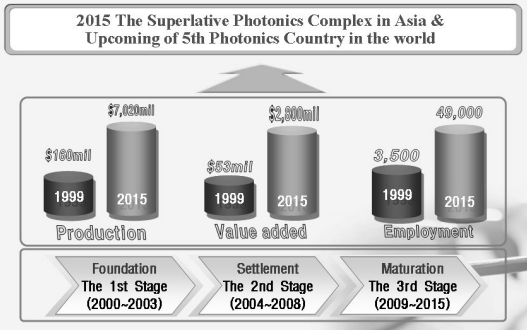
- **Export**
  - **Optical Information**
    Instrument ⇨ 78% (2006)

Photonics Industries in Gwangju

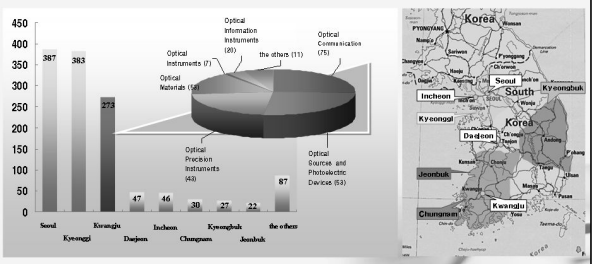
Procedure of Photonics Industry



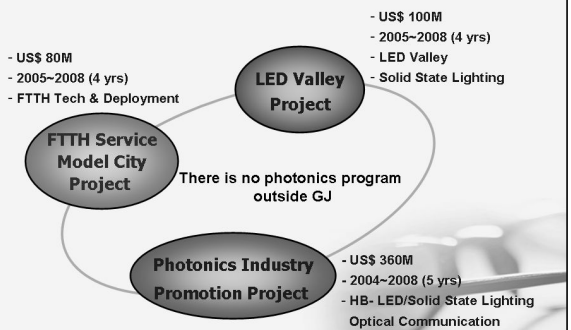
Expectation of Photonics Industry in GJ



Status of Photonics Industry in Korea

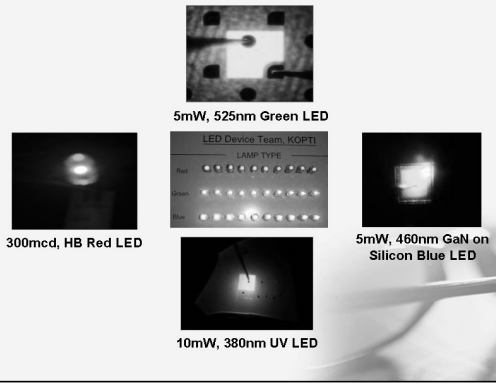


National Photonics Program in GJ

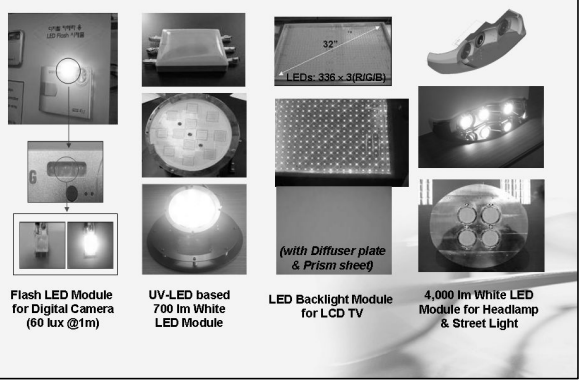


Strategic Photonics Area

HB-LED Chip

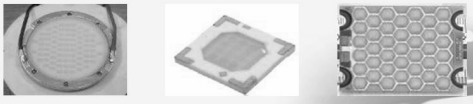


LED Module



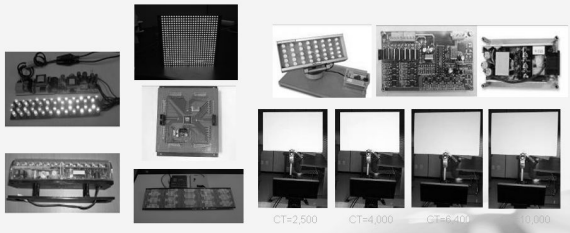
LED Module (con'd)

20W LED Bulb for Down light



HB-LED Multi-chip Module (40 lm/W)

Solid State Lighting Systems

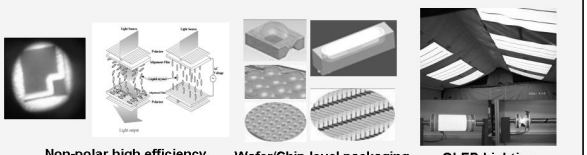


LED Lighting Bar

Full Color Display LED Module (24 Scan FPGA)

Intelligent Control of LED Color Temperature (Temp. range : 2,500 ~ 10,000K)

Solid State Lighting & Display



Non-polar high efficiency Vertical LED Chip

Wafer/Chip level packaging

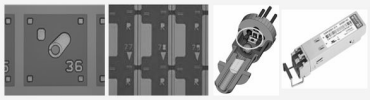
OLED Lighting

Low cost LED Backlight for large LCD TV

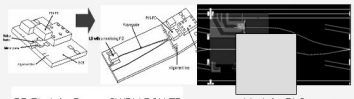
Smart LED Bulb

Mini Projector for Mobile Handset

Optical Communication Module

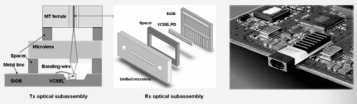


LD/PD Chip & Optical Transceiver (2.5/4/10G TRx)



Integrated Optical Module for CWDM-PON

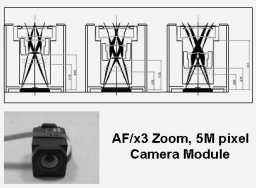
PD Block for Rx CWDM-PON TRx Mask for PLC



VCSEL-based Optical Module for Optical Digital Interface (12x2.5G TRx)

Camera Module

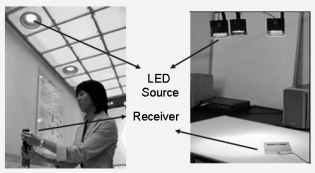
Aspherical Glass Lens for 3M pixel, 2.5x Zoom



AF/x3 Zoom, 5M pixel Camera Module

Shutter for 5M pixel CCD Camera Module

Ubiquitous Communication



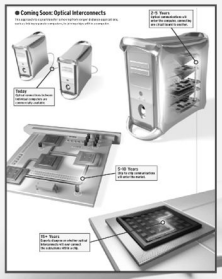
LED Source

Receiver

Visible Light Communication (Ubiquitous com. via lighting)

Optical home LAN

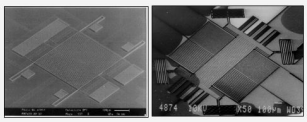
Smart Vehicle LAN



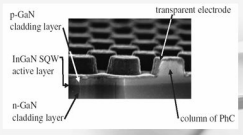
Optical Interconnect (system to system, board to board, chip to chip, intrachip)

Micro / Nano Optics

Ultra Precision Optics

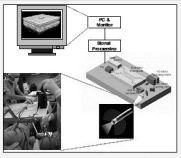


Optical MEMS (Micro Actuator, Sensor, Scanner)

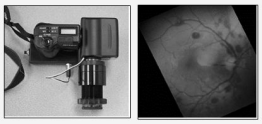


Nano Photonics

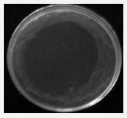
Biomedical Optics



Endoscope with OCT for in-situ tissue inspection

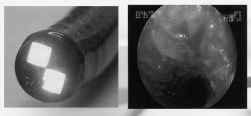


Eye-care imaging system (Digital retinal camera)



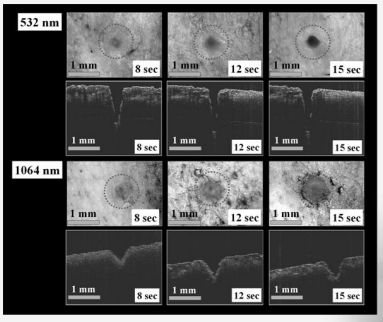
Wafer purification by UV-LED

UV light lamp for curing Osteoporosis



LED-based Endoscope

Biomedical Optics

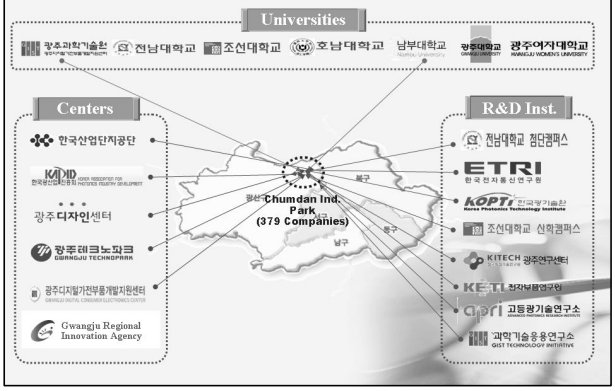


Comparison between OM images (the first and the third line) and OCT images (the second and the fourth line) of laser processed pig maxillary bone. The circle in each OM image indicates the laser processed region. The pig maxillary bone is processed by the Nd:YAG pulse laser with changing central wavelengths and exposure time at a fixed 20 Hz repetition rate.

Y. Shin and etc, 'Application of Optical Coherence Tomography for Functional Film Imaging', JKPS, 2008; 52, S62-S66

Photonics Cluster in Gwangju

R&D and Support Organizations



apri

Founded at GIST

Overview

- Established in 2001
- 2 Professors, 25 Sr. Research Scientists (Ph. D.), 15 Postdoc/Contracted Researchers, 8 Staffs (as of 2007, Total of 68+ in 2008)
- 10 Laboratory Groups:
  - Laser Spectroscopy, Femto Science, Nanophotonics, Optical Information & Communications, Nonlinear Optics, Biophotonics, Laser Science, Quantum Optics, Precision Optics, Optical Materials & Devices
- Femto Science and Technology Research Center
- Ultrashort Quantum Beam Facility (National / International User Facility)
- Open Laboratory Facility for Industrial Collaboration

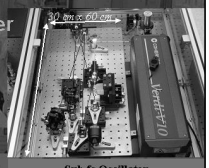
>10 Million USD of Annual Budget

Research Fields

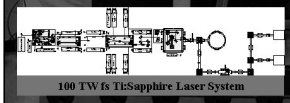
- High Power Laser Technology
- Laser Spectroscopy & Ultrafast Phenomena
- Femto Science and Technology
- Optical Materials and Devices (IT Integration)
- Nanophotonics (NT Integration)
- Biophotonics (BT Integration)
- Photonics Applications Research: High precision machining, Nanostructure manufacturing and New materials development
- Ultrafast Photo-biology / Chemical Reaction Dynamics Research

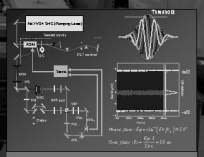
Femto Science Research

- Ultrahigh Intensity Femtosecond Laser
- Higher Harmonics Generation
- Laser Plasma Interaction
- X-ray, g-ray, Particle Generation
- High Field Science



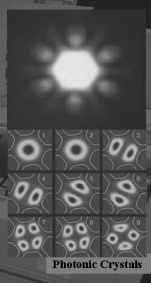
Sub fs Oscillator


100 TW fs Ti:Sapphire Laser System

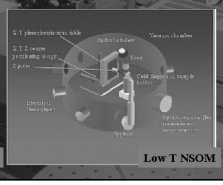

Carrier Envelop Phase Locking

Nanophotonics Research

- Near-Field Scanning Optical Microscopy (NSOM)
- Near-Field Fluorescence, Raman Spectroscopy
- Low Temperature NSOM for Quantum Structures
- Surface Plasmon Resonance Spectroscopy
- Photonic Crystals
- Pulsed Laser Deposition (PLD)
- Carbon Nanotubes, Quantum Well, Quantum Dot, etc.


Photonic Crystals

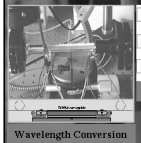

UV Room T NSOM

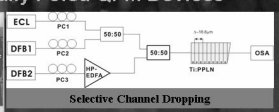

Low T NSOM

Optical Information & Communications Research

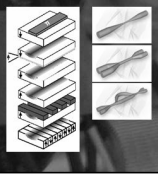
- All Optical Communications
- Optical Wavegiude
- Fiber Optic Devices
- Wavelength Conversion
- Solid State Optical Amplifier, Fiber Lasers
- Periodically Poled QPM Devices

Laser Utilized Fiber Tapering System


Wavelength Conversion

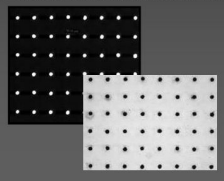


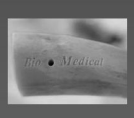
Selective Channel Dropping



Precision Manufacturing using fs Lasers

- Development of High Rep. rate fs Laser, pulse control for Precision Machining & Material Processing
- Photonic Devices
- Bio-medical Processing
- Nano fabrication & Nano Devices





Ultrashort Quantum Beam Facility

National User Facility
Korea's First and Only Facility

Application Field
- High field physics, Femto chemistry, Femto biology, Femto technology, etc.
- Ultrashort pulse source (X-ray, e-beam, protonbeam, etc) development, etc.
- High precision laser machining, etc.

Current User Groups
Domestic : KERI, KAIST, Samsung Electro-Mechanics, etc.
Foreign : JAEA (Japan), MBI (German), PALS(Czech Rep.), Cavendish Laboratory (U.K), etc.

Constructed in 2005
Peak Power : 100TW
Pulse Duration : 30 femtoseconds
Repetition Rate: 10Hz

Under construction
Peak Power : ~ Petawatt
Pulse Duration : 30 femtoseconds
Repetition Rate: ~0.1Hz

20 TW → 100 TW Amplifier System → 500 TW Power Amplifier System 1 → 1 PW Power Amplifier System 2

Ongoing Projects (2007)

- Management of APRI : 2.7 M USD
- Establishment of Petawatt-Class Ultrashort Quantum Beam Facility (National User Facility) : 9.5 M USD
- Research Collaboration with Cavendish Laboratory : 0.3M USD
- Northeastern Asia International Research Collaboration : 0.3M USD
- Development of ultra-compact and low-power consumption green light source for laser projection display : 0.6M USD
- Development of technology for And, several small research projects…

KOPTI

Started operation in Nov. 2004

Overview

- National R&D Institute
  - dedicated to Optics & Photonics area
- Started the operation in 2001
  - Land : 33,075㎡, Building : 31,293㎡
  - 20 Start-ups, 15 company for Pilot production
- 157 employees
  - 70% technical, 80% M.Sc. & Ph.D.
- Expected budget of $36M in 2007
  - 95% Government funding
  - 5% Industry funding (R&D contract, IP licensing)

KOPTI

R&D Infrastructure of KOPTI

Clean Room

Usage
- Fab. of HB-LED
- Fab of LD/PD Chip
- Precision Optics Component
- Pilot Prod. of LED/Com. Module

Main Clean Room 960m² | Semi Clean Room 450m² | 3,040m² | Pilot Productin CR 1630m²

Equipment
- Systematic build-up of expensive top-notch equipments
- 686 items ($74.6M)(2001~2006)

Best Institute in Optics/Photonics area

	R&D (01~04)	Pilot Prod. (05~06)	Total
Items	552	134	686
Amount ($M)	56.8	17.8	74.6

KOPTI

KOPTI's Laboratories

6 MOCVD for GaN
1 MOCVD for InGaAlP
2 MOCVD for InP
1 MBE for ZnO
Total 10 Growth Reactor

17 Labs.

Fabrication of Photonics Chip
Optoelectronics Design | Epitaxy | Material Characterization | Wafer Fabrication: Photo, Dry, Wet, Bar/Chip

Ass'y · Packaging
LED Package Design | Assembly & Packaging

Performance · Reliability Test
Performance Test | Reliability Test | Accel. Life Test | Testbed Center

Application Module
Ultra Precision Optics Process | Ultra Precision Measurement | LED Photometry | Standardization | Camera Module Test | Solid State Lighting Design | Solid State Lighting & Display

KOPTI

Major R&D Area in 2007

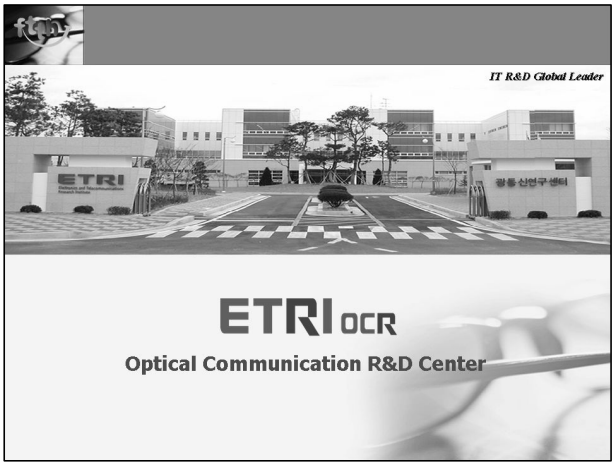
- Solid State Lighting & Display
  - Non-polar high efficiency vertical LED Chip
  - Wafer/Chip level packaging (Optics & Heat sink)
  - LED backlight for large LCD TV
  - OLED Lighting
  - Smart LED bulb for general illumination
  - LED/Laser Projection Display
- Ubiquitous Communication
  - Optical interconnect (chip-to-chip, board-to-board)
  - VLC (Visible Light Communication)
  - Optical Home LAN
  - Smart Vehicle LAN

KOPTI

Major R&D Area in 2007

- Biomedical Optics
  - Endoscope with OCT for in-situ tissue inspection
  - Eye-care imaging system
  - UV-B light exposure for curing osteoporosis
  - Water purification by UV-LED
- Micro/Nano Optics
  - Ultra Precision Optics
  - Nano Photonics
  - Optical MEMS (Micro Actuator, Scanner, Sensor)

KOPTI



Experimental Service R&D on FTTH

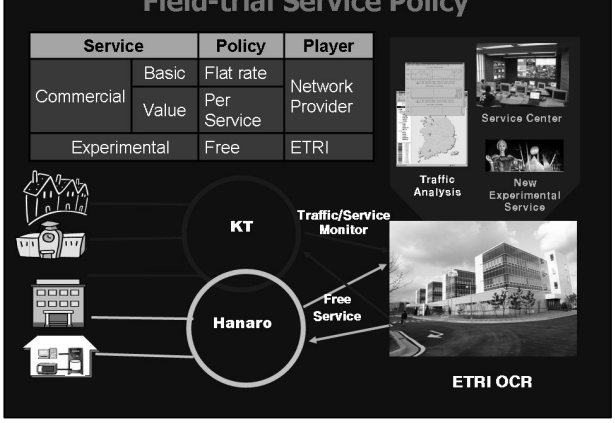
ETRI OCR

- Goal
  - Installing FTTH infra and deploying FTTH services
  - Developing Killer services and Systems, it's Trial
- Project Term: 2005 – 2009 (5 years)
  - Total budgets : $120 Millions
  - Objects
    - Installing FTTH infra for 20 thousands more subscribers
    - R&D for FTTH based C&B Convergence Services
    - R&D for Next Generation FTTH Solutions
    - BMT (Bench Mark Test) service for FTTH Systems
- Cooperate with Major Network Operators and CATV SO

Field-trial Service Policy

ETRI OCR

Service		Policy	Player
Commercial	Basic	Flat rate	Network Provider
	Value	Per Service	
Experimental		Free	ETRI



FTTH Service R&D Activities

ETRI OCR

- FTTH Service Technology
  - HD VoD, Interactive HD EoD Technology
  - Application Service & Contents
- FTTH Testing Technology
  - System Test Technique (Interoperability, etc)
  - Service Control & Operation (SLA Mgmt, QoS Probing, etc)
- Advanced FTTH System & Components
  - System Management, Open Access
  - Next-generation PON Optic Modules

SLA: Service Level Agreement, EoD: Education on Demand

KAPID

(Korea Association For Photonics Industry Development)

KAPID

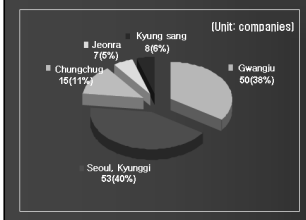
Overview

- Association founded in Gwangju in March 2000
- Partnership of Gwangju City and Ministry of Commerce, Industry and Energy
- Non-profit organization for promotion of National Photonics Industry
- Pursue mutual benefits and Suggesting opinions to the government
- Kapid is a key element in the Gwangju City's Photonics Industry Initiative strategy

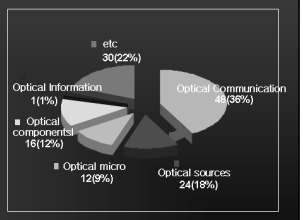
KAPID

KAPID Member Companies

- Number of KAPID Member Companies : 133 companies (May, 2006)
- Spread of Region



- Spread of Photonics filed



KAPID

Ongoing Projects

- 2008 International photonics exhibition & Int'l Photonics Technology Conference
  - Period : 2008. 9. 23 ~ 9. 25 (3Days)
  - Venue : Kimdaejung Convention Center, Gwangju, Korea
  - Hosted by : MOCIE, Gwangju City
  - Organized by : KAPID
  - Supported by : SPIE, OSK, COEMA, OSK, OITDA etc
  - Scope : Exhibition(200 companies 350 booths), Conference(650 papers)
- Photonics EXPO 2009
  - Period : 2009. 10. 9. ~ 11. 5. (28days)
  - Venue : Kimdaejung Convention Center, Sangmu citizen park area
  - Hosted by : MOCIE, Gwangju City
  - Organized by : KAPID
  - Main Event
    - Convention : International Photonics Exhibition & Conference
    - Event : International Fire work Show, Lighting Show, International Folk Festival ,etc

References

1. Y. Shin, Y. Kim, W. Kwak, E Choi, 'Application of Optical Coherence Tomography for Functional Film Imaging', JKPS, 2008; 52, S62-S66
2. GRIA, 'New R&D Projects and Business Models', 2007; 1-178
3. Y. Kim, E. Choi, W Kwak, Y. Shin, 'Three-dimensional non-destructive optical evaluation of laser-processing performance using optical coherence tomography', Optics & Laser Technology, Elsevier, 2008; 40, 625-631
4. Yong-Jin Shin, Young-Seop Kim, Hyunjin Kim, Woonggyu Jung, Zhongping Chen, Stuart Nelson, "Investigation of Pit Formation in Laser-irradiated Multilayer Thin Films by Using Optical Coherence Tomography", JKPS; 2006, 52, 184-187
5. Byungjo Jung, Bernard Choi, Yongjin Shin, J.S. Nelson, A.J. Durkin, "Determination of optimal view angles for quantitative facial image analysis", J. of Biomedical Optics, 2005, 10,40021-40027
6. W. Jung, J. Zhang, Y. Shin, A. Durkin, M. Reza, S. Nelson, J. Chen, "Optical coherence tomography in pulmonary imaging; Feasibility study", Progress in Biomedical Optics and Imaging (SPIE); 2004, 5,48-55

Have a Good Time in Cheongju !

조선대학교

Thank you

Thank you
Thank you
Thank you
Thank you
Thank you
Thank you
Thank you
Thank you
Thank you
Thank you

www.gria.or.kr

Laser Imaging Laboratory

제37회

대한의용생체공학회 춘계학술대회
발표논문초록

포스터 I 5월 9일, 14:30 ~ 16:00, D (2층 로비)

P1-1 ^{17}O NMR기법을 이용한 상자성 Gd(Ⅲ) 자기공명 조영제의 물 분자 교환율에 대한 연구
김희경[1], 김주현[1], 김인성[1], 우승태[1], 박지애[1], 장용민[1,2]
[1]경북대학교 대학원 의용생체공학과, [2]경북대학교 의과대학 영상의학과

P1-2 3-D DT-MRI Anisotropy의 Content에 Adaptive한 유한 요소 생성 방법의 개발
이원희, 김태성, 이수열
경희대학교 전자정보대학 동서의료공학과

P1-3 3T MREIT 시스템을 이용한 인체 종아리의 도전율 영상 복원
김형중[1], 김영태[1], 정우철[1], Atul S. Minhas[1], 우응제[1], 권오정[2]
[1]경희대학교 동서의료공학과, [2]삼성서울병원 호흡기내과, 성균관대학교 의과대학 내과학교실

P1-4 3-T MRI 탑재용 SSPM-PET 시스템의 위치결정 회로 성능 평가
권순일[1,2], 홍성종[3], 이또우 미끼꼬[4], 송인찬[3,5], 윤현석[1,6], 이건송[7], 이재성[1,2,3,6]
[1]서울대학교 의과대학 핵의학교실, [2]서울대학교 방사선응용 생명과학 협동과정, [3]서울대학교 방사선의학 연구소, [4]고려대학교 물리학과, [5]서울대학교병원 영상의학과, [6]서울대학교 의과대학 의과학과, [7]서울대학교병원 의공학과

P1-5 4층 구조 동물용 PET에 대한 각층별로 다른 에너지 윈도우를 사용한 Flood image
이또우 미끼꼬[1], 홍성종[2], 이재성[3], 권순일[3], 윤현석[3], 심광숙[1], 이경세[1], 홍병식[1], 이석재[4], 이준택[5]
[1]고려대학교 물리학과, [2]서울대학교 방사선의학과, [3]서울대학교 핵의학과, [4]서남대학교 의료공학과, [5]건국대학교 물리학과

P1-6 가상의 상대방에 대한 사회적 상호작용과 관련된 뇌 활성화
이형래[1], 구정훈[1], 이원호[1], 한기완[1], 박진식[1], 김재진[2], 김영수[3], 김인영[1], 김선일[1]
[1]한양대학교 의용생체공학과, [2]연세대학교 정신건강병원 행동과학 연구실, [3]한양대학교 의과대학 신경외과학교실

P1-7 고 에너지 전자선과 X-선에 의해 광섬유 방사선량계에서 발생되는 체렌코프 및 섬광빛의 측정
조동현, 장경원, 신상훈, 유욱재, 서정기, 이봉수
건국대학교 의료생명대학 의학공학부, 의공학 실용기술 연구소

P1-8 고주파 열치료용 비접촉식 적외선 광섬유 온도센서를 이용한 온도분포 측정
유욱재, 서정기, 조동현, 장경원, 신상훈, 이봉수, 정순철
건국대학교 의료생명대학 의학공학부, 의공학 실용기술 연구소

P1-9 공간과제 수행 시 산소공급에 따른 변연계 활성화 차이
서민지, 이행운, 이봉수, 정순철
건국대학교 의학공학부

P1-10 관류영상에서, 라인 정합을 이용한 혈관, 비 혈관 분류에 대한 연구
조성원, 김영재, 김광기, 조영호
국립 암 센터 기초과학연구부 의공학연구과

P1-11 다단 보간 기반의 광대역 초음파 빔집속 알고리듬
권오현, 성지빈, 송재희, 송태경
서강대학교 의공학 기술 연구센터

P1-12 다모드 디지털 영상 시스템 기반의 안면 피부 병변 진단을 위한 영상분석
배영우, 강희성, 손태윤, 류연항, 정병조
연세대학교 의공학과

P1-13 동력학모델 연구를 위한 Mixed LS-TLS 추정 알고리즘 기반의 다중선형화기법
김수진, 이재성, 이동수
서울대학교 협동과정 방사선응용생명과학 서울대학교 의과대학 핵의학교실

P1-14 반응깊이 정보를 얻을 수 있는 소동물용 PET 제작
홍성종[1], 이또우 미끼꼬[2], 권순일[3], 윤현석[3], 이건송[4], 심광숙[2], 박광석[4], 이준택[5], 이재성[3]
[1]서울대학교 방사선의학연구소, [2]고려대학교 물리학과, [3]서울대학교 핵의학교실, [4]서울대학교 의공학교실, [5]건국대학교 물리학과

P1-15 병렬 처리 구조의 GPU를 이용한 의료 초음파 영상장치용 디지털 주사선 변환기
서신혁, 손학렬, 송태경
서강대학교 공과대학 전자공학과

P1-16 새로운 PMAC 구조를 이용한 초음파 의료영상 시스템의 동적 데시메이션 필터 설계
이충, 김태완, 조정, 송태경
서강대학교 공과대학 전자공학과

P1-17 생리적 진단을 위한 포맷변화와 칼라링
윤문현, 최보영
가톨릭대학교 의과대학 의학공학교실

P1-18 소동물 전용 SPECT 시스템 개발을 위한 방사선 조준기 최적화
김중현, 이재성
서울대학교 의과대학 핵의학교실 서울대학교 방사선응용생명과학 협동과정

P1-19 스테레오 안저 영상을 이용한 시신경 패임 검출
김필운[1], 이윤정[1], 김명남[2]
[1]경북대학교 대학원 의용생체공학과, [2]경북대학교 의과대학 의공학교실

P1-20 시각 원근 조절 측정시스템 구현
이정은[1], 김휴정[2], 강한수[2], 정성택[1]
[1]한국산업기술대학교 컴퓨터 공학과, [2]포텍 마이크로 시스템

P1-21 시분할 다중 고주파 펄스 스위칭 회로 제작
김효근, 허혜영, 한병희, 조민형, 이수열
경희대학교 동서의료공학과

P1-22 실험계획법에 의한 간질액 내 글루코즈 농도 예측에 대한 타 성분 영향 분석
김혜정[1], 노인섭[2], 윤길원[1]
[1]서울산업대학교 의료전자연구소, [2]서울산업대학교 화학공학2

P1-23 안과 사진에서의 동공 자동분할 및 정량적 측정 프로그램 개발
김광기[1], 서종모[2], 조성원[1], 임혜원[1], 김영재[1,2], 조영호[1], 김태임[3], 유경상[3],김종효[4]
[1]국립암센타 기초실용화연구부 의공학연구과, [2]서울대학교 공과대학 전기공학부, [3]서울대학교병원 임상약리학교실, [4]서울대학교 방사선의학연구소

P1-24 양성자 자기공명분광법을 이용한 우울증 동물모델에서의 항우울제 약물 효능 평가
김상영[1], 최치봉[1], 지보근[3], 이성호[1], 우동철[1], 윤성익[1], 홍관수[2], 이현승[2], 정재준[2], 홍승탁[4], 김휘율[5], 최보영[1]
[1]가톨릭대학교 의과대학 의공학교실, [2]한국기초과학지원연구원 자기공명영상팀, [3]가톨릭대학교 의과대학 뇌신경과학센터, [4]Department of Ugurbil, Max-Planck Institute, [5]건국대학교 수의과대학

P1-25 열 치료용 비접촉식 광섬유 온도센서와 열원과의 관계 분석
서정기, 유욱재, 조동현, 장경원, 신상훈, 이봉수, 탁계래
건국대학교 의료생명대학 의학공학부, 의공학 실용기술 연구소

P1-26 유기섬광 광섬유 방사선 센서를 이용한 치료용 근접 방사선원의 상대깊이선량율 측정
신상훈[1], 조동현[1], 장경원[1], 유욱재[1], 서정기[1], 이봉수[1], 문주현[2], 김신[3]
[1]건국대학교 의료생명대학 의학공학부, 의공학 실용기술 연구소, [2]동국대학교 에너지·환경대학 에너지·환경시스템학부,

[3]제주대학교 에너지공학과, 방사선 기술 연구소

P1-27 자기공명분광분석법의 정도관리를 위한 장구형 팬톰의 개발

우동철[1], 김상수[2], 임향숙[2], 장건호[3], 백현만[4], O. Nalcioglu[4], 최치봉[1], 최보영[1]

[1]가톨릭대학교 의과대학 의공학교실, [2]분자생명의학과, [3]경희대학교 동서신의학병원 진단방사선과,

[4]John Tu and Thomas Center for Functional Onco-Imaging, University of Califorinia, Irvine, CA, USA

P1-28 자기공명온도 영상에서의 위상펼침

TAN KEE CHIN[1], 김태형[1], 천송이[1], 이광식[2], 신운재[3], 은충기[4], 전제량[4], 문치웅[1]

[1]인제대학교 의용공학과, [2]부산백병원 영상의학과, [3]동의과학대학 방사선과, [4]인제대학교 의과대학 영상의학과 부산백병원

P1-29 저선량 CT를 이용한 폐기종 분석 도구 개발: 잡음 감쇄 필터에 의한 재현성 개선 연구

박상준[1,2], 이창현[3], 허창용[1,2], 김영재[2], 김광기[4], 김종효[1,2,3]

[1]서울대학교 의과대학 방사선응용생명과학, [2]서울대학교병원 방사선의학연구소, [3]서울대학교병원 영상의학과,

[4]국립암센타 의공학과

P1-30 초음파 의료영상에서 Fourier Transform을 이용한 Digital Scan Conversion

안동기, 권성재, 정목근

대진대학교 전자공학과, 통신공학과

P1-31 컴프턴 카메라에 대한 분산감소 정규화 기법에 관한 연구

김 수미[1,2], 이재성[2], 김중현[1,2]

[1]서울대학교 방사선응용생명과학 협동과정, [2]핵의학교실

P1-32 펄스 반전 칼라 플로우 영상을 위한 π-초기화 IIR 필터를 이용한 클러터 제거 기법

이재진, 강현, 송재희, 송태경

서강대학교 의공학 기술 연구 센터

P1-33 하모닉 직교 복조 방식을 이용한 고조파 골레이 코드 여기 기법

김상민, 송재희, 송태경

서강대학교 의공학 기술 연구센터

P1-34 행작용 방법을 사용한 스플라인으로 정칙화된 최대우도 영상재구성

Van-Giang Nguyen, 이수진

배재대학교 전자공학과

P1-35 휴대용 초음파 영상장치를 위한 TMS320C6416기반의 후단신호처리 시스템의 설계 및 구현

권오현, 손학렬, 송태경

서강대학교 공과대학 전자공학과

P1-36 흉부 CT 영상에서의 형태학적 기법을 이용한 Honeycombing 자동검출

김영재[1], 박상준[1], 김광기[2], 허창용[1], 김종효[1]

[1]서울대학교병원 방사선의학연구소, [2]국립암센타 의공학과

P1-37 A Novel Method for Correction of Digital Image Distortion

Mohammad Abu yousuf, 최정민, 조민형, 이수열,

경희대학교 동서의료공학과

P1-38 AR 및 DSP 방법을 이용한 다중 동위원소 감마카메라 영상의 혼선 보정

박민재, 이재성, 박광석

서울대학교 협동과정 의용생체공학전공 서울대학교 의과대학 핵의학교실

P1-39 Conductivity Imaging of Postmortem Swine Legs using MREIT

A. S. Minhas, 김형중, 김영태, 정우철, 우응제

경희대학교 동서의료공학과

P1-40 DT-MR 영상에서 Successive Fermat 방법을 이용한 정규화에 관한 연구
김태환[1], 권기운[1], 정재원[1], 박인성[1], 한봉수[2], 김동윤[1]
[1]연세대학교 보건과학대학 의공학과, [2]방사선학과

P1-41 Hessian Matrix를 이용한 맘모그램의 미세석회화 군집 자동 검출 시스템
이화정, 김종효, 이준구
서울대학교 의과대학 방사선응용생명과학 협동과정

P1-42 Magnetic Nevigation of a Ferromagnetic Core Using MRI Gradient Coils
Koushik Kanti Mandal, 한병희, 강래훈, 하용현, 조민형, 이수열
경희대학교 동서의료공학과

P1-43 Maxwell 코일을 이용한 자기 추력에 관한 연구
하용현, 한병희, 강래훈, K. K. Mandal, 조민형, 이수열
경희대학교 전자정보대학 동서의료공학과

P1-44 MR 영상을 이용한 20대, 40대 정상 한국인의 안와 부피 계측
이수정[1], 김기연[1], 최미현[1], 이봉수[1], 이법이[2], 정순철[1]
[1]건국대학교 의학공학부, [2]건국대학교 해부학교실

P1-45 MREIT 영상의 개선을 위한 탄소-Hydrogel 전극
정우철, 김영태, A. S. Minhas, 김형중, 우응제
경희대학교 동서의료공학과

P1-46 MRI를 이용한 자성체의 위치 추적
강래훈, 한병희, 하용현, K. K. Mandal, 조민형, 이수열
경희대학교 전자정보대학 동서의료공학과

P1-47 Non-Cartesian k-space 샘플링을 이용한 3차원 자기공명영상 복원
고성민, 조상영, 김동현
연세대학교 전기전자공학과

P1-48 RF Shimming을 이용한 B_1^+ Field 균일도 개선
오정욱, 허혜영, 한병희, 조민형, 이수열
경희대학교 동서의료공학과

P1-49 고주파 열처리 실험을 위한 시스템 개발
강동원, 방윤환, 최진승, 이봉수, 탁계래
건국대학교 의학공학부

P1-50 중풍 동물모델에서 실시간 관찰을 통한 한방 침 지료에 따른 신경전달물질의 변화 연구
이기자[1,2], 어윤혜[1,2], 임지은[1,2], 최석근[3], 인창식[4], 박지혜[1,2], 박형준[1,2], 오범석[1,2,5], 박헌국[1,2,5]
[1]경희대학교 의과대학 의공학과, [2]경희대학교 의료산업연구원, [3]경희의료원 신경외과, [4]경희대학교 침구경락과학연구센터, [5]경희대학교 생체의과학 협동과정

P1-51 진동 및 전기 자극을 사용한 근 방추의 운동조절 공헌에 관한 실험 및 컴퓨터 시뮬레이션 스터디
유두희[1], Naoyuki Murakami[2], Shinsuke Yoshioka[2], Junichi Ushiyama[3], Senshi Fukashiro[1]
[1]Graduate School of Interdisciplinary Information Studies, University of Tokyo, Tokyo, Japan, [2]Dept. of Life Sciences, University of Tokyo, Tokyo, Japan, [3]Institute of Physical Education , Keio University, Tokyo, Japan

P1-52 Heat-mapping 기법을 이용한 가상공간에서의 공간적 head-gaze 분석 방법 개발: 예비연구
한기완[1], 구정훈[1], 신영석[1], 김진률[1], 박진식[1], 이형래[1], 김영수[2], 김인영[1], 김선일[1]
[1]한양대학교 의용생체공학과, [2]한양대학교 의과대학 신경외과학교실

P1-53 HRV 신호을 이용한 통증 측정에 관한 연구

박정훈[1], 이우철[2]
[1]안동과학대학 의료공학과, [2]을지대학교 의료공학과

P1-54 ISO 14971을 적용한 HEMODIALYZER 투석액 흐름의 측정오류에 대한 RISK MANAGEMENT에 관한 연구

전석봉[1], 문경석[1], 김승엽[1], 김홍규[1], 채영한[1], 이호석[1], 권혁남[1], 김병태[2]
[1]삼성서울병원 의공학과, [2]성균관대학교 의과대학

P1-55 건강 증진과 개인별 진단이 가능한 통합형 정보 시스템

사디아 말릭, 박승훈
경희대학교 전자정보대학 동서의료공학과

P1-56 일일 건강측정과 멘토링을 통한 생활습관 교정의 건강 증진 시스템

이고은, 김현숙, 장대근, 서상진, 박승훈
경희대학교 전자정보대학 동서의료공학과

P1-57 재택건강관리시스템 환경에서 응급 구조사를 위한 PDA컨텐츠 구성

심 훈[1,2], 김효민[1,2], 송상하[1,2], 이정훈[1,2], 이주환[1,2], 윤영로[1,2]
[1]연세대학교 대학원 의공학과, [2]재택건강관리시스템 연구센터

P1-58 정상 및 종양 유방조직의 도전율 측정

이대현[1], 송형근[2], 우응제[1]
[1]경희대학교 전자정보대학 동서의료공학과, [2]충북대학교의과대학 병리학교실

P1-59 Human Activity Recognition Using Augmented Autoregressive Model Coefficients from a Triaxial Accelerometer Signal

아딜 메무드 칸[1], 이영구[1], 김태성[2]
[1]경희대학교 전자정보대학 컴퓨터공학과, [2]경희대학교 전자정보대학 동서의료공학과,

P1-60 Independent Component Feature-based Human Activity Recognition via Linear Discriminant Analysis and Hidden Markov Model

엠디 지아 우딘, 이지준, 김태성
경희대학교 전자정보대학 동서의료공학과

P1-61 금속 나노선 구조를 이용한 고감도 표면 플라즈몬 공명 이미징 바이오센서에 관한 연구

변경민[1], 윤순준[2], 김동현[2]
[1]경희대학교 전자정보대학 동서의료공학과, [2]연세대학교 공과대학 전기전자공학부

P1-62 마이크로 전달 어드미턴스 스캐너의 개발에 대한 기초연구

구환, 권지현, 우응제
경희대학교 동서의료공학과

P1-63 생체 삽입형 기기를 위한 유연 인쇄 기판 기반 폐쇄 자기회로 구조의 무선 전력 전송 모듈

정기현, 김용호, 김용준
연세대학교 기계공학과

P1-64 유연인쇄회로기판과 MEMS 기술을 이용한 초소형 심전도 센서

김홍래, 김용호, 김용준
연세대학교 기계공학과

P1-65 낙상으로 인한 골절방지를 위한 시뮬레이션을 이용한 충돌면의 계수 연구

김성현[1], 김용욱[2], 김남균[3], 김동욱[3]
[1]전북대학교 대학원 의용생체공학과, [2]전북대학교 헬스케어 기술개발 사업단, [3]전북대학교 공과대학 바이오메티컬공학부

P1-66 광선 열자극 시 흰쥐의 회피반응 검출기

노정훈, 김명철, 예수영, 전계록
부산대학교 의학전문대학원 의공학과

P1-67 다 밴드 디지털 보청기 및 적합 모듈 개발
양동권[1], 방동혁[1], 전유용[1], 길세기[1,2], 이상민[1,2]
[1]인하대학교 전자공학과, [2]인하대학교 정보전자 공동연구소

P1-68 무릎 신전 모멘트 추정을 위한 사두근 건의 슬랙길이 추정
이우은, 남윤수, 엄현우
강원대학교 공과대학 기계메카트로닉스학부

P1-69 보행훈련기기의 기준규격 개발
황성재[1], 김정윤[1], 손종상[1], 문곤성[3], 강영규[2], 정희교[2], 김영호[1,3]
[1]연세대학교 의공학과, [2]식품의약품안전청, [3]연세대학교 의료공학연구원

P1-70 시-청각 단서 제공 읽기 훈련 프로그램
방동혁[1], 길세기[1,2], 권미선[3], 이상민[1,2]
[1]인하대학교 전자공학과, [2]인하대학교 정보전자 공동연구소, [3]서울아산병원 신경과

P1-71 신경전달물질 및 물리적 자극에 대한 뼈 세포의 반응
곽지현, 김병관, 이헌구, 김선영, 김지현
연세대학교 보건과학대학 의공학부

P1-72 신경회로망을 이용한 sit-to-stand 동작에서의 무릎 관절 모멘트 추정
이재강, 남윤수, 엄현우
강원대학교 공과대학 기계메카트로닉스공학부

P1-73 신발 굽 높이와 굽 적응여부에 따른 정적・동적 균형능력 비교
이현주[1], 태기식[2]
[1]안동과학대학 물리치료과, [2]건양대학교 의공학과

P1-74 난소절제술과 칼슘섭취 수준이 성장기 흰쥐의 요추에 미치는 영향
김치훈, 박지형, 우대곤, 임도형, 김한성
연세대학교 의공학부

P1-75 편마비환자의 행동특성 평가 및 자기수용감각 훈련을 위한 가상현실 시스템 개발: 예비 실험
조상우[1], 구정훈[1], 이형래[1], 이원호[1], 한기완[1], 박진식[1], 김홍준[2], 강윤주[2], 김영수[3], 김인영[1], 김선일[1]
[1]한양대학교 의용생체공학과, [2]을지병원 재활의학과, [3]한양대학교 의과대학 신경외과학교실

P1-76 하지 보조기 피드백 제어에 따른 일어서기 운동의 동력 보조 특성
김 경[1], 홍경주[1], 권대규[2,3], 김동욱[2], 김남균[2]
[1]전북대학교 대학원 의용생체공학과, [2]전북대학교 공과대학 바이오메디컬공학부, [3]전북대학교 고령친화복지기기연구센터

P1-77 Analysis on the Training Effects of Posture Control for the Elderly Adults
Yong-Jun Piao[1], Mi Yu[1], Tae-Kyu Kwon[2], Dong-Wook Kim[2], and Nam-Gyun Kim[2]
[1]Department of Biomedical Engineering, Graduate school, Chonbuk National University
[2]Division of Biomedical Engineering, College of Engineering, Chonbuk National University

P1-78 유한요소 분석을 이용한 한국형 인공 슬관절 대퇴 치환물의 설계
조명래[1], 서정희[1], 김정성[2], 김병수[2], 이성재[1]
[1]인제대학교 의용공학과, [2]코렌텍 중앙기술연구소

P1-79 ProDisc-L 다분절 시술에 따른 척추 분절의 운동성 및 후관절 하중 변화
전성철[1], Wen-Ming Chen[2], 박춘근[3], 이권용[4], 이성재[1]
[1]인제대학교 의용공학과, [2]싱가포르 국립대학 생체공학과, [3]가톨릭대학교 강남성모병원 신경외과, [4]세종대학교 기계공학과

P1-80 유한요소법을 이용한 치과용 임플란트 고정체 형태에 따른 응력 분석
문종필[1], 이성재[1], 박기훈[2]

[1]인제대학교 의용공학과, [2]신우산기

P1-81 다분절 퇴행성 요추 질환 치료를 위한 연성 척추 고정기기의 Hybrid 고정술에 따른 운동학적 분석 : 유한요소 해석연구

이재원[1], 박경우[2], 이성재[1]
[1]인제대학교 의용공학과, [2]광혜병원

P1-82 말초동맥 스텐트용 Zwitterionic PEG를 사용한 표면개질된 Nitinol-Au의 제조

신홍섭[1,3], 류현욱[1], 박귀덕[1], 문명운[2], 이광렬[2], 김지홍[3], 한동근[1]
한국과학기술연구원 [1]바이오소재연구센터, [2]계산과학센터, [3]성균관대학교 화학공학과

P1-83 생리활성 PLA/β-TCP복합지지체를 이용한 조직공학적 골 재생

정영미[1], 박민성[2], 이진우[2], 김영하[3], 김상헌[1], 김수현[1]
[1]한국과학기술연구원 바이오소재연구센터, [2]연세대학교 정형외과학교실, [3]광주과학기술원 신소재공학과

P1-84 유도가열에 의한 약물방출형 Thermorod의 약물 방출특성 연구

추현욱[1], 최성민[1], 박재근[1], 황은미[1], 박혜진[1], 조현설[2], 박주환[3], 김영곤[1]
[1]인제대학교 의생명공학대학 의용공학과, [2]광양보건대학 의료공학과, [3]고려상사(주)

P1-85 주기적인 유체를 가한 해면골 조직에 배양된 Pre-osteoblasts에 대한 연구

김병관, 곽지현, 이헌구, 김선영, 김지현
연세대학교 보건과학대학 의공학부

P1-86 Mechanical Loading이 임신 쥐의 Primary 뼈 세포에 미치는 영향

이헌구, 김병관, 곽지현, 김지현
연세대학교 의학공학과

학생논문경연

5월 9일, 15:30 ~ 18:00, A (대강당)

S-1 한국인 체형에 적합한 인공슬관절의 굽힘 각도 변화에 따른 역학적 특성 비교 분석

서정희[1], 조명래[1], 김정성[2,3], 김병수[2], 선두훈[2,4], 이성재[1]
[1]인제대학교 의용공학과, [2]코렌텍 중앙기술연구소, [3]연세대학교 의과대학 BK21 사업단, [4]대전 선병원 관절센터

S-2 실시간 피질 리듬 모니터링 시스템을 이용한 뇌-컴퓨터 접속(BCI)에서의 Motor Imagery 훈련 시스템 개발

황한정, 서기현, 최기정, 김은빈, 권기운, 임창환
연세대학교 보건과학대학 의공학과

S-3 컴프턴 영상 시스템을 위한 경계보전 최대사후 영상재구성

이미노, Van-Giang Nguyen, 이수진
배재대학교 전자공학과

S-4 전기자극에 의한 Neuronal cell migration에 대한 연구

정세훈[1,3], 전상범[2,3], 송종근[2,3], 김성준[1,2,3]
[1]서울대학교 뇌과학협동과정, [2]서울대학교 전기컴퓨터공학부, [3]초미세 생체전자 시스템 연구센터

S-5 PDMS와 Silver Ball 기반의 생체적합성 멀티채널 표면전극 제작과 Nerve Conduction Study에 적용

이은중[1], 백동현[1,3], 백주열[1], 김병조[2], 박정호[3], 이상훈[1]
[1]고려대학교 보건과학대학 생체의공학과, [2]고려대학교 병원 신경과, [3]고려대학교 전기 전자공학과

S-6 인지능력 평가를 위한 소프트웨어 구현

류완석[1,2], 김동한[1], 허준행[1], 김휴정[2], 강한수[2], 정성택[1]
[1]한국산업기술대학교 컴퓨터공학과, [2]포텍마이크로시스템

구연논문 Ⅰ

5월 9일, 15:30 ~ 18:00, B (1층 회의실)

좌장 | 정병조(연세대), 윤종인(대구가톨릭대)

O1-1 포토닉스 기반의 나노 바이오 융합 기술
조용훈
충북대학교 물리학과, 나노-바이오-포토닉스 연구실

O1-2 Introduction to Frequency-Domain Optical Coherence Tomography as a Biomedical Imaging Modality
최은서
조선대학교 물리학과

O1-3 Ultra-high-speed optical spectroscopy in time-wavelength technique with a stretched pulse supercontinuum source
김덕영
광주과학기술원, 정보통신공학과

O1-4 봉한 경락계의 imaging
소광섭
서울대 물리학과

O1-5 Applications of diffuse optics in humans and small animals
김법민
연세대학교 보건과학대학 의공학부

구연논문 Ⅱ

5월 9일, 15:30 ~ 18:00, C (2층 강의실)

좌장 | 이종민(한양대), 최홍호(인제대)

O2-1 Image Intensifier를 이용한 Micro-CT System의 개발
최정민, 김규원, 한병희, 조민형, 이수열
경희대학교 전자정보대학 동서의료공학과

O2-2 Image Intensifier를 이용한 Micro-CT System의 개발
최정민, 김규원, 한병희, 조민형, 이수열
경희대학교 전자정보대학 동서의료공학과

O2-3 프레임율이 향상된 3차 고조파 검출 기법
송재희, 김상민, 송태경
서강대학교 의공학 기술 연구 센터

O2-4 [^{18}F]FDG PET을 이용한 토끼 망막에서의 시각 및 전기 자극에 따른 당대사량 활성화 비교
김수진, 이재성, 우세준, 김의태, 서종모, 김성준, 이동수
서울대학교 협동과정 방사선응용생명과학, 서울대학교 의과대학 핵의학교실, 서울대학교 의과대학 안과학교실
서울대학교 공과대학 전기.컴퓨터공학부, 초미세생체전자시스템연구센터, 나노인공시각개발센터

O2-5 최대선량깊이에서의 광섬유 방사선량계의 선형성 평가 및 상대깊이선량율 측정
장경원[1], 조동현[1], 신상훈[1], 유욱재[1], 서정기[1], 이봉수[1], 조효성[2], 김신[3]
[1]건국대학교 의료생명대학 의학공학부, 의공학 실용기술 연구소, [2]연세대학교 보건과학대학 방사선학과
[3]제주대학교 에너지공학과, 방사선 기술 연구소

포스터Ⅱ 5월 10일, 9:00 ~ 10:30, D (2층 로비)

P2-1 기류 상승속도를 고려한 최대호식기류 보정기법
김경아, 이인광, 최성수, 김성식, 차은종
충북대학교 의과대학 의공학교실, 충북 BIT 연구중심대학사업단

P2-2 동맥 혈관의 압력-용적 모델에 기반한 위상관계 천이양상
정재희, 김명철, 예수영, 노정훈, 전계록
부산대학교 의학전문대학원 의공학과

P2-3 맥파 신호의 특성 임피던스 관찰
유주연[1], 김명철[1], 최병철[2], 예수영[3], 김길중[4], 정동근[5], 전계록[6]
[1]부산대학교 의과대학 의공학 협동과정, [2]춘해대학 의료공학과, [3]부산대학교 의과전문대학원 BK21 사업단,
[4]동서대학교 전자공학과, [5]동아대학교 의과대학 의공학교실, [6]부산대학교 의학전문대학원 의공학교실

P2-4 맥파의 특징점 검출에 의한 PWV 변화 양상 관찰
김명철[1], 유주연[1], 손정만[2], 김길중[3], 정동근[4], 노정훈[5], 전계록[5]
[1]부산대학교 의과대학 의공학 협동과정, [2]춘해대학 의료공학과, [3]동서대학교 전자공학과,
[4]동아대학교 의과대학 의공학교실, [5]부산대학교 의학전문대학원 의공학교실

P2-5 무구속 심박 모니터링 시스템에서의 비정상 심박동 검출에 대한 선행 연구
이효기[1], 조성필[1], 송미혜[1], 이경중[1,2]
[1]연세대학교 의공학과, [2]연세대학교 이동형응급의료정보시스템개발센터 (CEMI)

P2-6 무선 전력 전송 시스템에서 안정된 전력 공급을 위한 코일 송수신 회로의 최적화된 설계 기법
최성욱, 윤종서, 심은보
강원대학교 공과대학 기계메카트로닉스공학과

P2-7 무선 헤드셋 PPG 전송 장치
홍주현, 차은종, 이태수
충북대학교 의과대학 의공학교실

P2-8 바이오 레이더 시스템을 이용한 비접촉방식의 생체신호 측정
신재연[1], 박호동[1], 장병준[2], 이윤수[3], 이경중[1]
[1]연세대학교 의공학과, [2]국민대학교 전자공학부, [3](주) 유비즈플러스

P2-9 박동형 생명구조장치의 동기구동 기법 개발
김종세, 최성욱
강원대학교 공과대학 기계메카트로닉스공학과

P2-10 비활성 영역을 이용한 심전도 기저선의 제거에 관한 연구
조은석, 차 샘, 주장규, 이기영
관동대학교 정보통신공학과, 의료공학과, 명지대학교 전자공학과

P2-11 손목 부착형 생체신호 모니터링 시스템
강구태[1], 정동근[1], 하정서[1], 예수영[2], 전계록[2]
[1]동아대학교 의과대학 의공학교실, [2]부산대학교 의공학협동과정

P2-12 심전도와 광전용적맥파를 이용한 재택형 심혈관 건강관리시스템의 설계 및 구현
송상하, 고현철, 장희원, 이정훈, 윤영로
연세대학교 의공학과

P2-13 와류형 호흡기류 센서의 압력-기류 특성
이인광, 최성수, 김군진, 장종찬, 김성식, 김경아, 차은종

충북대학교 의과대학 의공학교실, 충북 BIT 연구중심대학사업단

P2-14 이벤트-레코더 기능을 가지고 있는 휠체어용 생체계측 시스템

한동균, 김종명, 차은종, 이태수
충북대학교 의과대학 의공학교실

P2-15 자동 혈압측정기기의 능동적 가/감압 목표치 설정을 위한 가압단계 MAP 추정

오홍식[1], 지영준[1], 이종실[1], 김영수[2], 김인영[1], 김선일[1]
[1]한양대학교 학과간협동과정 의용생체공학과, [2]한양대학교 의과대학 신경외과

P2-16 전동휠체어용 생체계측 시스템의 성능평가

한동균, 김종명, 홍주현, 차은종, 이태수
충북대학교 의과대학 의공학교실

P2-17 착용형 생체신호계측 단말장치

홍주현, 차은종, 이태수
충북대학교 의과대학 의공학교실

P2-18 측정 자세에 따른 Pulse Wave 파라미터의 변화에 관한 연구

김은근, 허현, 남기창, 허영
한국전기연구원

P2-19 퍼지 논리를 이용한 인체 활동량 및 체온의 변화에 따른 심장 박동수 예측 전문가 시스템 구현

신광수, 김진권, 이병우, 이명호
연세대학교 공과대학 전기전자공학과

P2-20 Hierarchical classification을 이용한 부정맥 자동진단 알고리즘의 성능향상

이도훈[1], 조백환[1], 박관수[1], 송수화[1], 이종실[1], 지영준[1], 김인영[1], 김선일[1], 김영수[2]
[1]한양대학교 의용생체공학과, [2]한양대학교 의과대학 신경외과

P2-21 PPG 신호처리를 이용한 호흡수 검출 연구

이은미, 김내현, 웬퇴창, 홍주현, 차은종, 이태수
충북대학교 의공학교실

P2-22 Sevoflurane 마취 중 pulse transit time변화에 따른 교감신경계의 효과

예수영[1], 백승완[2], 김태균[2], 김길중[3], 남기곤[4], 정동근[5], 전계록[6]
[1]부산대학교 의과전문대학원 BK 사업단, [2]부산대학교 의학전문대학원 마취통증의학교실, [3]동서대학교 전자공학과, [4]부산대학교 전자공학과, [5]동아대학교 의공학교실, [6]부산대학교 의학전문대학원 의공학교실

P2-23 가속도센서와 자이로센서를 이용한 낙상 알고리즘

박진[1], 김용욱[2], 김동욱[3], 김남균[3]
[1]전북대학교 대학원 헬스케어공학과, [2]전북대학교 헬스케어 기술 개발 사업단, [3]전북대학교 공과대학 바이오메디컬공학부

P2-24 각근력 측정이 가능한 전자 브레이크 엔진의 제작과 각근력 측정 알고리즘 설계 및 구현

서상진, 전융진, 손대홍, 박승훈
경희대학교 전자정보대학 동서의료공학과

P2-25 고휘도 녹색 LED 광원이 골수 및 조직 세포 증식에 미치는 효과

천민우[1], 김성환[1], 박용팔[2], 김영표[2], 유성미[3], 김태곤[4]
[1]조선대학교 의과대학 의학과, [2]동신대학교 보건복지대학 병원의료공학과, [3]광주보건대학 간호과, [4](주)바이오아테코 인공장기 연구소

P2-26 다자세 제어가 가능한 휠체어용 의자의 설계

배주환, 문인혁
동의대학교 메카트로닉스공학과

P2-27 바이오센서 개발을 위한 CuPc/C_{60} 이중층을 이용한 유기 광기전 소자의 전기적 특성
이호식[1], 천민우[2], 유성미[3], 박용필[1]
[1]동신대학교 병원의료공학과, [2]조선대학교 의학과, [3]광주보건대 간호학과,

P2-28 산소포화도 측정기의 Central Monitoring System 구현
김종철[1], 권예원[1], 조신희[1], 정현애[1], 정석범[1], 기선우[1], 천승민[1], 서기홍[1], 권혁남[1], 김병태[2]
[1]삼성서울병원 의공학과, [2]성균관대학교 의과대학

P2-29 세포내 미토콘드리아의 대사 활성을 위한 레이저 조사장치의 개발
김유석, 심은보, 최성욱
강원대학교 기계메카트로닉스 공학부

P2-30 심박보조 장비 개발을 위한 EMG 시뮬레이터
박현철, 김진권, 이충근, 신항식, 정완진, 이명호
연세대학교 전기전자공학과

P2-31 외이도에 마이크로폰을 이식하는 완전 이식형 인공중이에서의 음향 궤환 현상을 고려한 마이크로폰 이식 위치 결정
김동욱[1], 성기웅[1], 김민우[1], 이장우[1], 정의성[1], 임형규[1], 이정현[2,3], 조진호[1,2,3]
[1]경북대학교 대학원 전자전기컴퓨터학부, [2]경북대학교병원 의공학과, [3]경북대학교 첨단 감각기능 회복장치 연구센터

P2-32 유비쿼터스 헬스시스템에서의 이중 무선채널을 통한 생체신호 모니터링 개선
최경호, 허영정, 전병우, 박찬오, 차용대, 윤길원
서울산업대학교 의료전자연구소

P2-33 의료 환경에서 사용되는 의료기기 Risk Management 방안
오주현[1], 신택수[1], 김종순[1], 김서확[1], 신동익[2], 허수진[2]
[1]서울아산병원 의공학과, [2]울산대학교 의과대학 의공학교실

P2-34 인간공학적 요소를 적용한 드럼식 세탁기 디자인 개발 시 제시된 요소들의 영향 평가
조영근[1,2], 김현동[1,2], 최현호[3], 강기영[4], 임도형[1,2], 김한성[1,2]
[1]연세대학교 의공학과, [2]연세대학교 의료공학연구원, [3]U&I Corp., [4]LG Corp.

P2-35 인간공학적 요소를 적용한 청소기 디자인 개발 시 고려되어야 할 사항 제시
조영근[1,2], 김현동[1,2], 최현호[3], 강기영[4], 임도형[1,2], 김한성[1,2]
[1]연세대학교 의공학과, [2]연세대학교 의료공학연구원, [3]U&I Corp., [4]LG Corp.

P2-36 입력전원이 의료용 X-선 고전압장치에 미치는 전원특성 시험
김영표[1], 박용필[1], 이호식[1], 천민우[2], 김태곤[3]
[1]동신대학교 보건복지대학 병원의료공학과, [2]조선대학교 의과대학 의학과, [3](주)바이오아테코 인공장기연구소

P2-37 저에너지 방사선 측정을 위한 CsI(Tl) 섬광검출기 특성실험 장치
심상현[1], 진계환[1], 이상복[1], 이준행[1], 이삼열[1], 이태수[2]
[1]남북대학교 방사선학과, [2]충북대학교 의과대학 의공학교실

P2-38 정적인 자세의 동요분석을 위한 장치와 알고리즘
박장호, 서상진, 손대홍, 박승훈
경희대학교 전자정보대학 동서의료공학과

P2-39 태권도 품새의 신체활동 분석
이상복, 홍주현, 차은종, 이태수
충북대학교 의과대학 의공학교실

P2-40 피부조직에서의 와전류 분포 분석 시뮬레이션
조동국, 이균정, 신태민
연세대학교 보건과학대학 의공학과

P2-41 헬스케어로봇을 위한 공통 인터페이스 기술의 개발
양용주, 문동주, 이성일
한국생산기술연구원 로봇기술본부 제어・인식팀

P2-42 EPMR을 활용한 의료기기 관리효율 향상을 위한 고찰
서현원[1], 안호문[1], 김원규[1], 이호석[1], 김태종[1], 임효순[1], 권혁남[1], 김병태[1,2]
[1]삼성서울병원 의공학과, [2]성균관대학교 의과대학

P2-43 FET 바이오센서 개발을 위한 CuPc Field-effect Transistor의 전기적 특성
이호식, 박용필
동신대학교 병원의료공학과

P2-44 Loadcell을 이용한 악력 측정 시스템 구현
이성호, 유현준, 고화영, 강한수, 정성택
한국산업기술대학교 컴퓨터공학과

P2-45 PC 기반의 순음 청력 자가 측정 기법 개발
조현준[1,2], 권세윤[1], 김희평[1], 지윤상[1], 김영수[3], 김인영[1], 김선일[1]
[1]한양대학교 의과대학 의공학교실, [2]한양대학교 전기제어생체공학부, [3]한양대학교 의과대학 신경외과

P2-46 뇌 신호원의 시계열 추출 및 인과성 분석에 있어서 ICA 기반 접근법과 MUSIC 기반 접근법의 성능 비교 및 문제점 진단
정영진, 이진영, 이정희, 임창환
연세대학교 의공학부

P2-47 멀티 스케일 엔트로피를 이용한 정상인과 간질환자 뇌파의 복잡도 정량화
신병철[1], 송인호[1], 이종실[1], 지영준[1], 김영수[2], 김인영[1], 김선일[1]
[1]한양대학교 의용생체공학과, [2]한양대학교 의과대학 신경외과

P2-48 서파 차단을 통한 변성망막 마우스의 전기자극 최적화
예장희, 구용숙
충북대학교 의과대학 생리학교실

P2-49 인공와우의 어음처리기법에 적용하기 위한 힐버트 변환과 energy operator의 비교
최성진, 김경환
연세대학교 보건과학대학 의공학과

P2-50 작업난이도에 따른 시각 oddball 작업 수행 시 위상 동조 분석
윤진, 김자현, 김경환
연세대학교 보건과학대학 의공학과

P2-51 정상망막과 변성망막의 전기자극 파라미터 비교
예장희, 구용숙
충북대학교 의과대학 생리학교실

P2-52 개인의 효율적인 건강관리를 위한 헬스인덱스의 개발
양용주, 문동주, 이성일
한국생산기술연구원 로봇기술본부 제어・인식팀

P2-53 골프 퍼팅 동작의 일관성 판단에 관한 연구
이성대[1], 김형식[1], 최진승[1], 강동원[1], 임영태[2], 탁계래[1], 이정한[1]
[1]건국대학교 의료생명대학 의학공학과, [2]건국대학교 스포츠과학부 골프지도학과

P2-54 뇌간기능 평가를 위한 Mayer wave에 대한 예비 연구
백현재[1], 김정수[1], 김고근[1], 안원식[2], 김동욱[3], 박광석[4]
[1]서울대학교 협동과정 바이오엔지니어링, [2]서울대학교병원 마취통증의학과, [3]성균관대학교 통계학과,

[4]서울대학교 의과대학 의공학과

P2-55 미세유체 칩을 이용한 전기화학적 면역진단 센서 제작
유성주[1,2], 최영봉[2], 주종일[1], 김혁한[2], 이상훈[1]
[1]고려대학교 보건과학대학 생체의공학과, [2]단국대학교 첨단과학대학 화학과

P2-56 복강경 수술로봇의 원격 제어
박준우[1], 최재순[2], 이덕희[1], 임영빈[1], 조영호[1]
[1]국립암센터 연구소 의공학연구과, [2]고려대학교 한국인공장기센터

P2-57 BPN 알고리즘을 이용한 얼굴 인식 시스템
서광욱, 민병로, 김동우, 홍준택, 이민영, 정현웅, 최동석, 화윤일, 이대원
성균관대학교 생명공학부 바이오메카트로닉스학과

P2-58 초음파 영상용 플라스틱 기반의 phantom제작 및 특성 분석
이균정, 박동희, 신태민, 서종범
연세대학교 보건과학대학 의공학과

구연논문Ⅲ

5월 10일, 10:30 ~ 12:30, B (1층 회의실)

좌장 | 이태수(충북대), 최병철(춘해대)

O3-1 대동맥 경화도 측정법에 대한 고찰
서지혜[1], 최동호[1], 오수경[1], Rainer Rienmueller[2], 이종민[1,3]
[1]경북대학교 대학원 의용생체공학과, [2]Univ.-Klinik f. Radiologie, [3]경북대학교 의과대학 영상의학과

O3-2 고차 통계와 Hermite Basis 함수를 이용한 SVM 기반 심박동 분류
박관수[1], 조백환[1], 이도훈[1], 송수화[1], 이종실[1], 지영준[1], 김영수[2], 김인영[1], 김선일[1]
[1]한양대학교 의용생체공학과, [2]한양대학교 의과대학 신경외과

O3-3 휴대형 무선 3채널 심전계의 성능 평가
홍주현, 차은종, 이태수
충북대학교 의과대학 의공학교실

O3-4 바이오센서용 착용형 전류계측 시스템
강구태[1], 정동근[1], 심윤보[2]
[1]동아대학교 의과대학 의공학교실, [2]부산대학교 화학과

O3-5 최소 침습 수술 로봇을 위한 관절형 Instrument 개발
이민영, 민병로, 김동우, 서광욱, 홍준택, 정현웅, 최동석, 화윤일, 이대원
성균관대학교 생명공학부 생명공학과

구연논문Ⅳ

5월 10일, 10:30 ~ 12:30, C (2층 세미나실)

좌장 | 탁계래(건국대), 김경환(연세대)

O4-1 생체 삽입형 SU-8 마이크로전극의 제작과 Neural Interface를 위한 평가
이대호[1], 백주열[2], 백동현[3], 이은중[4], 최지현[5], 이민아[5], 이상훈[1]
[1]고려대학교 보건과학대학 생체의공학과, [2]연세대학교 보건과학대학 의공학부, [3]고려대학교 전기전자공학과,

[4]고려대학교 의료정보기기학과, [5]한국과학기술연구소(KIST)

O4-2 인공망막의 최적자극조건을 찾기 위한 전기자극세기 변조를 통한 망막신경절세포의 발화율 변화 관찰

류상백[1], 김경환[1], 예장희[2], 구용숙[2]
[1]연세대학교 보건과학대학 의공학과, [2]충북대학교 의과대학 생리학 교실

O4-3 인지과제의 종류에 따른 보행 패턴의 변화에 대한 연구

최진승, 강동원, 정순철, 탁계래
건국대학교 의학공학부

O4-4 The Effect of Vibratory Stimuli on Supporting Leg during One-Legged Standing in the Elderly

유미[1], 박용군[1], 김동욱[2], 김용욱[3], 권대규[2,4], 김남균[2]
[1]전북대학교 의용생체공학과, [2]전북대학교 바이오메디컬공학부, [3]전북대학교 헬스케어기술개발사업단,
[4]전북대학교 실버공학연구센터

O4-5 척추 측만이 족저압 분포에 미치는 영향에 관한 연구

박재현, 노시철, 장화선, 최흥호
인제대학교 의생명공학대학 의용공학과

포스터 Ⅰ

P1-1 | p1-p3 | 5월 9일 | 2층 로비

^{17}O NMR기법을 이용한 상자성 Gd(Ⅲ) 자기공명 조영제의 물 분자 교환율에 대한 연구

김희경[1], 김주현[1], 김인성[1], 우승태[1], 박지애[1], 장용민[1,2]
[1]경북대학교 대학원 의용생체공학과, [2]경북대학교 의과대학 영상의학과

^{17}O NMR Study On Water Exchange Rate of Paramagnetic Gd(Ⅲ) MR Contrast Agents

Hee Kyung Kim[1], Joo Hyun Kim[1], In Seong Kim[1], Seung Tae Woo[1], Ji Ae Park[1], Yong Min Chang[1,2]
[1]Department of Biomedical Engineering, Kyungpook National University,
[2]Diagnostic Radiology, School of Medicine, Kyungpook National University

Abstract

Water exchange rate is important to determine efficiency of MR paramagnetic contrast agent. ^{17}O-NMR technique is useful to measure the water exchange rate of paramagnetic Gd(Ⅲ) MR contrast agents.

This study aimed for measuring water exchange rate of MR paramagnetic contrast agent, Gd-DTPA, Gd-DTPA-BMA, Gd-DOTA, S3L2(Gd(L2)H_2O) and S3L3(Gd(L3)H_2O). The S3L2 and S3L3 were developed from existing research by our laboratory. These were showed high relaxivity[1][2][3]. Therefore, new contrast agents S3L2 and S3L3 are expected better impact than other Gd(Ⅲ) contrast agents.

P1-2 | p4-p6 | 5월 9일 | 2층 로비

3-D DT-MRI Anisotropy의 Content에 Adaptive한 유한 요소 생성 방법의 개발

이원희, 김태성, 이수열
경희대학교 전자정보대학 동서의료공학과

3-D DT-MRI Anisotropy Content-Adaptive Finite Element Mesh Generation for Bioelectromagnetic Problems

W. H. Lee, T.-S. Kim, and S. Y. Lee
Department of Biomedical Engineering, Kyung Hee University, Republic of Korea

Abstract

Realistic finite element (FE) head models have been successfully applied to bioelectromagnetic problems due to a realistic representation of arbitrary head geometry with inclusion of anisotropic materials. In this paper, we propose a new automatic FE mesh generation technique to generate a DT-MRI white matter anisotropy content-adaptive FE head model. We term this kind of mesh as *wMesh*. With this meshing technique, the anisotropic electrical conductivities derived from DT-MRIs can be best incorporated into the FE model. For demonstration, wMesh head models generated from a 3-D complex MR volume are presented. We believe that this fully automatic anisotropy-adaptive wMesh generation scheme could be useful for modeling of individual-specific FE head models with the better incorporation of the anisotropic property towards bioelectromagnetic problems.

P1-3 | p7-p9 | 5월 9일 | 2층 로비

3T MREIT 시스템을 이용한 인체 종아리의 도전율 영상 복원

김형중[1], 김영태[1], 정우철[1], Atul S. Minhas[1], 우응제[1], 권오정[2]
[1]경희대학교 동서의료공학과, [2]삼성서울병원 호흡기내과, 성균관대학교 의과대학 내과학교실

In Vivo Conductivity Imaging of a Human Calf Using a 3T MREIT System

H. J. Kim[1], Y. T. Kim[1], W. C. Jeong[1], A. Minhas[1], E. J. Woo[1] and O. J. Kwon[2]
[1]Department of Biomedical Engineering, Kyung Hee University, Korea,
[2]Division of Pulmonary and Critical Care Medicine, Department of Medicine, Samsung Medical Center, Sungkyunkwan University School of Medicine, Korea

Abstract

Conductivity imaging using Magnetic Resonance Electrical Impedance Tomography (MREIT) has been tried to visualize a conductivity distribution inside phantoms and animals. This paper reports our first human imaging experiment. Here we show that it is possible to reconstruct high-resolution conductivity images of a human calf using carbon-hydrogel electrodes and optimized RF coil. Reconstructed multi-slice conductivity images with a pixel size of 1.7 mm show a clear contrast between muscle and bone. In some regions, conductivity images show a clear contrast among muscles which is hardly observed in MR magnitude images. Following proposed future work, the ability to acquire high-resolution conductivity images will find numerous clinical applications not supported by other medical imaging modalities.

P1-4 | p10-p13 | 5월 9일 | 2층 로비

3-T MRI 탑재용 SSPM-PET 시스템의 위치결정 회로 성능 평가

권순일[1,2], 홍성종[3], 이또우 미끼꼬[4], 송인찬[3,5], 윤현석[1,6], 이건송[7], 이재성[1,2,3,6]
[1]서울대학교 의과대학 핵의학교실, [2]서울대학교 방사선응용 생명과학 협동과정, [3]서울대학교 방사선의학 연구소,
[4]고려대학교 물리학과, [5]서울대학교병원 영상의학과, [6]서울대학교 의과대학 의과학과, [7]서울대학교병원 의공학과

Performance test of a position sensing board for a SSPM-PET insert to a 3-T MRI

S. I. Kwon[1,2], S. J. Hong[3], M. Ito[4], I. C. Song[5], H. S. Yoon[1,6], G. S. Lee[7], J. S. Lee[1,2,6]
[1]Department of Nuclear Medicine, College of Medicine, Seoul National University,
[2]Interdisciplinary Programs in Radiation Applied Life Science Major, Seoul National University,
[3]Institute of Radiation Medicine, Medical Research Center, Seoul National University,
[4]Department of Physics, Korea University, [5]Department of Diagnostic Radiology, Seoul National University,
[6]Department of Medical Science, Seoul National University,
[7]Department of Biomedical Engineering, Seoul National University

Abstract

In previous study, we have achieved the possibility of SSPMs used in PET detector module for high intensity magnetic field like MRI. For developing fully new PET system, the new position sensing circuit for SSPM module is needed. The analog encoding module that we propose provides event positions from each basic SSPM block. The basic detector block was consisted of one SSPM module and one LYSO (4.0x4.0x10.0 ㎣) crystal. We present a basic performance of detector board module using 22Na. It shows a clear separation of individual crystals and each block has an energy resolution of ~20%.

In 3-T MRI environment. we obtained ~17% energy resolution and ~2.9 ns coincidence time resolution outside and inside MRI bore. With the various MRI sequences, we obtained ~20% energy resolution and ~3.1 ns coincidence time resolution.

P1-5 | p14-p17 | 5월 9일 | 2층 로비

4층 구조 동물용 PET에 대한 각층별로 다른 에너지 윈도우를 사용한 Flood image

이또우 미끼꼬[1], 홍성종[2], 이재성[3], 권순일[3], 윤현석[3], 심광숙[1], 이경세[1], 홍병식[1], 이석재[4], 이준택[5]
[1]고려대학교 물리학과, [2]서울대학교 방사선의학과, [3]서울대학교 핵의학과, [4]서남대학교 의료공학과, [5]건국대학교 물리학과

Flood Image using Different Energy Window for Each Layer of Four-Layer Configuration Animal PET

M. Ito[1], S. J. Hong[2], J. S. Lee[3], S. I. Kwon[3], H. S. Yoon[3], K. S. Sim[1], K. S. Lee[1], B. Hong[1], S. J. Lee[4], J. T. Rhee[5]
[1]Department of Physics, Korea University
[2]Institute of Radiation and Medicine, Seoul National University College of Medicine
[3]Department of Nuclear Medicine, Seoul National University College of Medicine
[4]Department of Biomedical Engineering, Seonam University, [5]Department of Physics, Konkuk University

Abstract

We have developed the four-layer configuration animal PET system with improve sensitivity and spatial resolution, achieved by employing long crystal blocks and the depth-of-interaction (DOI) analysis to eliminate the parallax error. The each layer of four-layer configuration aligned with a relative off-set so that the DOI information of four layers can be extracted from a flood image.

The flood image has been calculated by 4 output signal of a charge division circuit connected to 256 channels of the flat multi-channel PMT (H9500) for Photoelectric events. However, mean values of photoelectric peaks for 4 layers are different in energy distribution. Consequently we calculated the flood image for photoelectric events selected using different energy window for each layer of four-layer configuration.

P1-6 | p18-p21 | 5월 9일 | 2층 로비

가상의 상대방에 대한 사회적 상호작용과 관련된 뇌 활성화

이형래[1], 구정훈[1], 이원호[1], 한기완[1], 박진식[1], 김재진[2], 김영수[3], 김인영[1], 김선일[1]
[1]한양대학교 의용생체공학과, [2]연세대학교 정신건강병원 행동과학 연구실, [3]한양대학교 의과대학 신경외과학교실

Brain Activity of Social interaction with virtual other

H. R. Lee[1], J. H. Ku[1], W. H. Lee[1], K. W. Han[1], J. S. Park[1], J. J. Kim[2], Y. S. Kim[3], I. Y. Kim[1] and S. I. Kim[1]
[1]Department of Biomedical Engineering, Hanyang University
[2]Institute of Behavioral Science in Medicine, Yonsei University Severance Mental Health Hospital
[3]Department of Neurosurgery, College of Medicine, Hanyang University

Abstract

Recently, the advent of a virtual avatar, which mimics the appearance and behavior of humans, enable that the virtual reality (VR) can provide not only a virtual space but also a virtual society to be interact with a virtual avatar which represents humans. But, it is impossible that the user directly interacts with the VE in previous studies, though direct interactions occur in real social relationship. Therefore, In this study, we know that the cognition about a avatar when the user directly interacts with the virtual avatar in the VE. In order to investigate this purpose, we performed a fMRI study using VE that a avatar accept or reject the user's offer when the user offer his (or her) hand to a avatar. In result of questionnaire about the user's feeling by avatar's action, the user feels about avatar's acceptance action that the avatar acts positively and suitably. In contrast the user feels about avatar's rejective action that the avatar acts negatively and disapprovingly. The insula lobe and thalamus activate during the other avatar's rejective actions contrasted to acceptance actions. The superior frontal gyrus and superior temporal gyrus more activate during the other avatar's acceptance actions contrasted to rejective actions. The results show that it is possible to transfer social context and emotion through avatar's action.

P1-7 | p22-p24 | 5월 9일 | 2층 로비

고 에너지 전자선과 X-선에 의해 광섬유 방사선량계에서 발생되는 체렌코프 및 섬광빛의 측정

조동현, 장경원, 신상훈, 유욱재, 서정기, 이봉수
건국대학교 의료생명대학 의학공학부, 의공학 실용기술 연구소

Measurements of Cerenkov and Scintillating light Generated in a Fiber-optic Dosimeter irradiated by High Energy Electron and Photon Beams

D. H. Cho, K. W. Jang, S. H. Shin, W. J. Yoo, J. K. Seo, B. Lee
School of Biomedical Engineering, Research Institute of Biomedical Engineering,
College of Biomedical & Health Science, Konkuk University

Abstract

The objectives of this study are to measure Cerenkov light generated in a fiber-optic dosimeter by electron and photon beams, and to compare them. The intensity of Cerenkov light is measured and characterized as functions of incident angles of the electron and photon beams from a clinical linear accelerator. Also, the scintillating light which is generated from fiber-optic dosimeter is measured using a charge-coupled device.

P1-8 | p25-p28 | 5월 9일 | 2층 로비

고주파 열치료용 비접촉식 적외선 광섬유 온도센서를 이용한 온도분포 측정

유욱재, 서정기, 조동현, 장경원, 신상훈, 이봉수, 정순철
건국대학교 의료생명대학 의학공학부, 의공학 실용기술 연구소

Measurements of Temperature Distributions Using a Noncontact Fiber-optic Temperature Sensor for Radiofrequency Ablation

W. J. Yoo, J. K. Seo, D. H. Cho, K. W. Jang, S. H. Shin, B. Lee and S. C. Chung
School of Biomedical Engineering, Research Institute of Biomedical Engineering,
College of Biomedical & Health Science, Konkuk University

Abstract

Radiofrequency ablation (RFA) technique is use of heat to destroy tissue and tumor structures. Radiofrequency current between the ground plate and the electrode causes movement of ions in the tissue, which results in heating of the tissue surrounding the tip of electrode. Thermal damage depends on the tissue temperature reached and the duration. The problems with a heating is the accurate measurement and control of temperature in the RFA treatment. For this purpose, we have developed a noncontact temperature sensor using an infrared optical fiber for the RFA treatment. We have measured an infrared radiation which is transferred by a silver halide optical fiber from the heat on the water around inserted electrode using a thermopile sensor. And we have compared the output voltages of a thermopile sensor with the output values of the thermocouple recorder.

P1-9 | p29-p31 | 5월 9일 | 2층 로비

공간과제 수행 시 산소공급에 따른 변연계 활성화 차이

서민지, 이행운, 이봉수, 정순철
건국대학교 의학공학부

Activation of Limbic Area due to Oxygen Administration during Visuospatial Task

M. J. Seo, H. W. Lee, B. Lee, S. C. Chung
Department of Biomedical Engineering, Konkuk University

Abstract

본 연구에서는 산소 농도 21%에 비해 고 농도(30%)의 산소 공급이 공간 과제 수행 시 변연계의 활성화에 어떠한 변화를 유발하는지 관찰하였다. 총 8명의 오른손잡이 남자 대학생을 본 연구의 실험 참여자로 선정하였다. 실험 참여자에게 21%와 30%의 산소 농도를 각각 8L/min의 양으로 일정하게 공급하면서 공간 과제를 수행하도록 하였다. 동시에 3T MRI를 이용하여 뇌기능 영상을 획득하였다. 두 가지 산소 농도에 따라 활성화 되는 변연계 영역은 동일하였다. 그러나 21%에 비해 30%농도 일 때 대상이랑 (cingulate gyrus)과 시상 (thalamus) 영역에서 활성화가 증가하였다.

P1-10 | p32-p35 | 5월 9일 | 2층 로비

관류영상에서, 라인 정합을 이용한 혈관, 비 혈관 분류에 대한 연구

조성원, 김영재, 김광기, 조영호
국립 암 센터 기초과학연구부 의공학연구과

In perfusion MRI, a study to distinguish between vascular and non-vascular region using line fitting.

S. W. Jo, Y.J. Kim, K. G. Kim, Y. H. Jo
Biomedical Engineering Branch, Division of Basic Science, National Cancer Center

Abstract

Gamma variate curve fitting technique has been used to describe the enhancement by bolus.
However, bolus dosen't work in the non-vascular region, so gamma curve fitting is not available technique.
In this study, we proposed a method to distinguish between vascular and non-vascular region using line fitting. We verify that tangent of the linear equation solved by line fitting can be used as a parameter that distinguish between vascular and non-vascular region.

P1-11 | p36-p38 | 5월 9일 | 2층 로비

다단 보간 기반의 광대역 초음파 빔집속 알고리듬

권오현, 성지빈, 송재희, 송태경
서강대학교 의공학 기술 연구센터

A Wide-band Ultrasound Beamforming Algorithm Based on Multi-stage Data Interpolation

O. H. Kwon, J. B. Sung, J. H. Song and T. K. Song
Center for Medical Solutons Research, Sogang University

Abstract

Ultrasound harmonic imaging requires a wider bandwidth beamformer because it should extract harmonic signals from the received signals. We propose a beamforming method using two cascaded 2-fold interpolation filters to perform 4-fold interpolation required for fine delay control. The proposed beamformer performs better in a wider frequency band than the conventional single-stage interpolation beamformers with the same hardware complexity, since the transition bandwidth of each interpolation filter is increased in the proposed scheme. Computer simulation results show that the proposed beamformer is able to improve the performance of ultrasound harmonic imaging by reducing interpolation error by up to 9 dB at frequencies higher than 6MHz.

P1-12 | p39-p40 | 5월 9일 | 2층 로비

다모드 디지털 영상 시스템 기반의 안면 피부 병변 진단을 위한 영상분석

배영우, 강희성, 손태윤, 류연항, 정병조
연세대학교 의공학과

Digital Image Analysis for the Diagnosis of Facial Skin Lesion Using Multi-mode Photographic Imaging System

Y. W. Bae, H. S. Kang, T. Y. Soon, Y. H. Ryu, B. J. Jung
Department of Biomedical Engineering, Yonsei University

Abstract

In dermatology, various imaging modalities have been developed as an assistant tool to objectively evaluate the treatment efficacy of facial skin lesion. In this study, we propose some imaging analysis methods to evaluate various facial skin lesion using multi-mode photographic imaging system. Our imaging system provides four different digital color images of standard digital color image, parallel and cross polarization digital color image, and UV-A induced fluorescent digital color image. In conclusion, by analyzing the color information and morphological features, we were able to simultaneously evaluate various skin lesions with the imaging analysis methods.

P1-13 | p41-p44 | 5월 9일 | 2층 로비

동력학모델 연구를 위한 Mixed LS-TLS 추정 알고리즘 기반의 다중선형화기법

김수진, 이재성, 이동수
서울대학교 협동과정 방사선응용생명과학
서울대학교 의과대학 핵의학교실

A Mixed LS-TLS Based Multiple Linear Analysis for Kinetic Modeling Studies

S. J. Kim, J. S. Lee, D. S. Lee
Interdisciplinary Program in Radiation Applied Life Science, Seoul National University
Department of Nuclear Medicine, Seoul National University College of Medicine

Abstract

In many linearized algorithms, kinetic modeling data can be mixed with error-free (input function and integral of tissue TAC) and error-in (tissue TAC) values in independent variables. In this study, we suggest new approach considering different error properties in independent variables using mixed LS-TLS method. We applied proposed approach to a multiple linear regression method for quantification of the net accumulations (Ki) of irreversible radioligands (MLAIR) on region of interest. The new approach's properties were investigated through Monte Carlo simulation. Estimated values showed better bias and coefficient of variation properties than other linear methods. This approach could be applied to any linear regression method for unbiased parameter estimation in kinetic modeling studies.

P1-14 | p45-p48 | 5월 9일 | 2층 로비

반응깊이 정보를 얻을 수 있는 소동물용 PET 제작

홍성종[1], 이또우 미끼꼬[2], 권순일[3], 윤현석[3], 이건송[4], 심광숙[2], 박광석[4], 이준택[5], 이재성[3]
[1]서울대학교 방사선의학연구소, [2]고려대학교 물리학과, [3]서울대학교 핵의학교실, [4]서울대학교 의공학교실, [5]건국대학교 물리학과

Construction of a Small Animal PET System with Depth of Interaction Information

S. J. Hong[1], M. Ito[2], S. I. Kwon[3], H. S. Yoon[3], G. S. Lee[4], K. S. Sim[2], K. S. Park[4], J. T. Rhee[5], J. S. Lee[3]
[1]Institute of Radiation and Medicine, Seoul National University College of Medicine,
[2]Department of Physics, Korea University,
[3]Department of Nuclear Medicine, Seoul National University College of Medicine,
[4]Department of Biomedical Engineering, Seoul National University College of Medicine,
[5]Department of Physics, Konkuk University,

Abstract

Improving spatial resolution without sacrificing sensitivity is one of the most challenging goals for small animal PET scanners. To meet the challenging goals, we are constructing a 3-layer animal PET system which provides information on depth of interaction (DOI). For an intermediate step toward the 3-layer PET system, we are constructing a 1-layer PET system with 6 H9500 PMTs each of which is mounted with 29x29 $L_{0.9}$GSO crystals. A 2-layer PET module was also built and tested to verify the DOI capability. We present the current status of the 1-layer PET system and test results of the 1-layer and 2-layer PET modules.

P1-15 | p49-p53 | 5월 9일 | 2층 로비

병렬 처리 구조의 GPU를 이용한 의료 초음파 영상장치용 디지털 주사선 변환기

서신혁, 손학렬, 송태경
서강대학교 공과대학 전자공학과

A Digital Scan Converter for Medical Ultrasound Imaging System Using a GPU with Massively Parallel Processing Architecture

S.H. Seo, H.Y. Sohn, T.K. Song
Department of Electronic Engineering, Sogang University

Abstract

This paper presents the method and results of the software implementation of a digital scan converter for medical ultrasound imaging system, using a GPU (NVIDIA G80). The digital scan conversion process is modified in a SIMD manner suitable for the GPU's massively parallel processing architecture so that the GPU's 128 ALUs are utilized nearly 100%. The preliminary result for a frame of image composed of 256 scan lines, each having 1024 16-bit samples, shows that the digital scan converter can be processed at a high rate of 1639 frames per second when implemented in C, which is four times faster than the optimized assembly codes running on the TI's TMS320C6416 DSP.

P1-16 | p54-p56 | 5월 9일 | 2층 로비

새로운 PMAC 구조를 이용한 초음파 의료영상 시스템의 동적 데시메이션 필터 설계

이충, 김태완, 조정, 송태경
서강대학교 공과대학 전자공학과

Design of Dynamic Decimation Filter Using novel PMAC Structure In A Medical Ultrasound Imaging System

C. Lee, T.W. Kim, J. Cho, T. K. Song
Department of Electronic Engineering, Sogang University

Abstract

The proposed method is based on the novel PMAC(polyphase multiplication and accumulate) approach, which allows to change the decimation ratio and the associated filter coefficients dynamically with a fixed minimum hardware structure.

The PMAC-based dynamic filtering architecture is optimized for a medical ultrasound imaging system requiring a dynamic decimation ratio of M/2 where M is any integer number greater than 2.

P1-17 | p57-p59 | 5월 9일 | 2층 로비

생리적 진단을 위한 포맷변화와 칼라링

윤문현, 최보영
가톨릭대학교 의과대학 의학공학교실

Format conversion and coloring for Physiologic dignosis

Moon-Hyun Yoon, Bo-Young Choe
Department of Biomedical Engineering, College of Medicine, The Catholic University of Korea

Abstract

This study was performed to increase understanding of how imaging information yields details about underlying function. However , we will restrict ourselves to two-dimensional (2D) image processing and gray color although most of the concepts and techniques that are to be described can be extended easily to three or more dimensions and the RGB color models. Different image processing systems use different color models for different reasons. Human perception of color is a function of the response of three types of cones. Because of that, color systems are based on three numbers and prevent Dial-a-Tear effect on knee image on PACS. These numbers are called tristimulus values. In this course, we will explore the RGB color models to gray color of analyze format. These additional studies can be focused on the MR imaging parameters judged to be the most efficient at depicting cartilage matrix deterioration. In this way, MR imaging findings may prove to be surrogate markers of biomechanical and biochemical measures and thus be used for the early detection of articular disorders and to facilitate successful surgical interventions and drug therapies.

P1-18 | p60-p62 | 5월 9일 | 2층 로비

소동물 전용 SPECT 시스템 개발을 위한 방사선 조준기 최적화

김중현, 이재성
서울대학교 의과대학 핵의학교실
서울대학교 방사선응용생명과학 협동과정

Optimization of radiation collimator for development of small animal dedicated SPECT system

J. H. Kim, J. S. Lee
Department of Nuclear Medicine, College of Medicine, Seoul National University
Interdisciplinary Programs in Radiation Applied Life Science Major, Seoul National University

Abstract

Small animal dedicated SPECT system was proposed as pre-clinical study tools of nuclear medicine for development of new radio-pharmaceuticals or tracer kinetic study of many tracers. In this study, we designed the collimator that can control the direction of radiation for portable SPECT system using GATE (Geant4 applications for tomographic emission) simulation code. The collimator consists of 128x128 square holes in 49x49 mm^2 area, and each holes were separated by 0.38 mm. The material of collimator was Tungsten(W). The original density of Tungsten is 19.3 g/cm^3, however the density in micro structures, cannot achieve the original density. The expected density was 8.0～8.5 g/cm^3 and 9.0～9.5 g/cm^3 for 0.04 mm and 0.08 mm septal thickness, respectively. We verified the sufficiency of septal thickness for 35.5 keV, the maximum gamma ray energy of I-125, and 140.5 keV, the gamma ray energy of Tc-99m. For 35.5 keV, 0.04 mm septal thickness with 8.0 g/cm^3 density was sufficient to block nearly all septal penetration. For 140.5 keV, 0.08 mm septal thickness with 9.5 g/cm^3 was not sufficient to block septal penetration. In this study, the optimized septal condition for 35.5, 140.5 keV was selected and this information will be useful to design the collimator geometry.

P1-19 | p63-p65 | 5월 9일 | 2층 로비

스테레오 안저 영상을 이용한 시신경 패임 검출

김필운[1], 이윤정[1], 김명남[2]
[1]경북대학교 대학원 의용생체공학과, [2]경북대학교 의과대학 의공학교실

Extraction of an optic cup by using the stereo fundus image

P. U. Kim[1], Y. J. Lee[1], and M. N. Kim[2]
[1]Dept. of Medical and Biological Engineering, Graduate School, Kyungpook National University,
[2]Dept. of Biomedical Engineering, School of Medicine, Kyungpook National University

Abstract

In this paper, we present the extraction method of an optic cup from the stereo fundus image. An optic cup is a very important factor in diagnosis of glaucoma. Although it could be found in the common retina image, it is hard to extract it with the detecting method based on image intensity. Actually, because it is made by structural variation of retina, it could be extracted by combining the image intensity and depth of an retina. The depth of retina was acquired by the stereo fundus image. To extract an optic cup, the active contour model was modified to take account of the depth. Additionally, to overcome the movement problem eye and retina scope occurred during taking the stereo image, the interpolation method was proposed. The proposed method was confirmed by simulating and validating with 40 stereo fundus images.

P1-20 | p66-p68 | 5월 9일 | 2층 로비

시각 원근 조절 측정시스템 구현

이정은[1], 김휴정[2], 강한수[2], 정성택[1]
[1]한국산업기술대학교 컴퓨터 공학과, [2]포텍 마이크로 시스템

Implementation of a Visual Accommodation System

J. E. Lee[1], H. J. Kim[2], H. S. Kang[2], S. T. Chung[1]
[1]Dept. of Computer Engineering, Korea Polytechnic University, [2]Foretek Microsystem

Abstract

In this paper, we implemented the system for measuring of the visual accommodation, it was formed Landolt's ring using red LED and could be accommodated by convex and concave lens. We measured visual accommodation for twenty-six weight-stable subjects (17 men, 9 women) aged 20-29. The experimental results of both men and women are 5.13D and 5.05D, respectively.

P1-21 | p69-p72 | 5월 9일 | 2층 로비

시분할 다중 고주파 펄스 스위칭 회로 제작

김효근, 허혜영, 한병희, 조민형, 이수열
경희대학교 동서의료공학과

Fabrication of the time-multiplexed RF pulse switching circuit

H.G Kim, H.Y. Heo, B.H. Han, M.H. Cho, S.Y. Lee
Department of Biomedical Engineering, Kyung Hee University, Korea

Abstract

The B1 field inhomogeneity is troublesome in high field MRI over 3 Tesla. Various methods have been proposed to mitigate the B1 field inhomogeneity effects. New RF coil configurations using multi-channel transmit techniques are among them. In the transmit SENSE technique, the magnitude and phase of the RF pulse to be applied to each coil element are optimized to reduce the standing wave effect. In this study, we propose a new technique to improve the B1 homogeneity for the high field MRI. Instead of applying a continuous RF pulse to the single volume coil, we apply chopped RF pulses to the phase array coil in the time-multiplexed mode. We describe implementation of the switching circuit to chop the RF pulse at 127MHz.

P1-22 | p73-p76 | 5월 9일 | 2층 로비

실험계획법에 의한 간질액 내 글루코즈 농도 예측에 대한 타 성분 영향 분석

김혜정[1], 노인섭[2], 윤길원[1]
[1]서울산업대학교 의료전자연구소, [2]서울산업대학교 화학공학2

Analysis of the Influence of Other Components on the Prediction of Glucose Concentration in Interstitial Fluid by Design of Experiments.

H. J. Kim[1], I. S. Noh[2], G. Yoon[1]
[1]Institute for Biomedical Electronics, Seoul National University of Technology,
[2]Department of Chemical Engineering, Seoul National University of Technology

Abstract

Interferences by other substances were examined when glucose concentration in the interstitial fluid was predicted using infrared absorption spectroscopy. Particularly sodium lactate, one of the components whose spectrum heavily overlaps with glucose, was the main substance of our investigation.

A qualitative study was possible by applying a design of experiments(DOE). A total of 16 samples were produced; four levels of glucose (0.0-10.0 g/dl), four levels of sodium lactate (0.0-1.0 g/dl), and two levels of solution (triply distilled water, 0.9% saline solution). Absorption spectra were measured between 1000-1500 cm^{-1} which contains the fundamental glucose absorption. Then partial least squares regression(PLSR) was performed. The sample group composed of only glucose produced a standard error of prediction(SEP) of 0.1792 g/dl and R=0.9990, and the sample group composed of glucose and sodium lactate SEP=0.4846 g/dl and R=0.9925. Prediction error of the sample group containing sodium lactate was 270% higher than that of the sample group consisted only of glucose. In addition, we examined the effect of sodium lactate concentrations in the glucose prediction using Taguchi method of DOE. The higher sodium lactate concentration was, the more it affected the accuracy of the prediction of glucose concentration. Therefore, the compensation of sodium lactate is required in glucose prediction.

P1-23 | p77-p78 | 5월 9일 | 2층 로비

안과 사진에서의 동공 자동분할 및 정량적 측정 프로그램 개발

김광기[1], 서종모[2], 조성원[1], 임혜원[1], 김영재[1,2], 조영호[1], 김태임[3], 유경상[3],김종효[4]
[1]국립암센타 기초실용화연구부 의공학연구과, [2]서울대학교 공과대학 전기공학부,
[3]서울대학교병원 임상약리학교실, [4]서울대학교 방사선의학연구소

Automatic pupil size analysis using morphological analysis for pupillary light reflex analysis

K. G. Kim[1], J. M. Seo[2], S. W. Cho[1], H.W. Im[1], J. H. Kim[1,2], Y. J. Kim[1], Y.H. Cho[3], T,I, Kim[3], K. S. You[4]
[1]Department of Biomedical Engineering, National Cancer Center, Gyeonggi-Do, Korea,
[2]Department of electrical engineering, Seoul national University, Seoul, Korea,
[3]Department of clinical pharmacology, Seoul national University, Seoul, Korea,
[4]Institute of Radiation Medicine, Seoul National University Hospital, Seoul, korea

Abstract

Accurate measurement of pupil size is essential for pupillary light reflex (PLR) analysis in clinical diagnosis and vision research. Low pupil-iris contrast, corneal reflection, artifacts and noises in eye imaging pose challenges for automated pupil detection and size measurement. This paper describes a computerized method for pupil size measurement. After segmentation by threshold, pupil are detected by labeling and morphological method and RGB, HSV color information. and we applied elliptical fitting methods and size measurement. Experimental results with 50 images showed a mean absolute difference of between light condition and no light measurement. statistically, significant different light and no light condition for PLR($p<0.005$). The computerized method could facilitate PLR analysis.

P1-24 | p79-p80 | 5월 9일 | 2층 로비

양성자 자기공명분광법을 이용한 우울증 동물모델에서의 항우울제 약물 효능 평가

김상영[1], 최치봉[1], 지보근[3], 이성호[1], 우동철[1], 윤성익[1], 홍관수[2], 이현승[2], 정재준[2], 홍승탁[4], 김휘율[5], 최보영[1]
[1]가톨릭대학교 의과대학 의공학교실, [2]한국기초과학지원연구원 자기공명영상팀,
[3]가톨릭대학교 의과대학 뇌신경과학센터, [4]Department of Ugurbil, Max-Planck Institute, [5]건국대학교 수의과대학

Evaluation of Antidepressant Drug Effect in Depressive Animal Model by Proton MR Spectroscopy

S.Y. Kim[1], C.B. Choi[1], B.K. Jee[3], S.H. Lee[1], D.C. Woo[1], S.I. Yoon[1], K.S. Hong[2], H.S. Lee[2], C.J. Cheong[2], S.T. Hong[4], H.Y. Kim[5], B.Y. Choe[1]
[1]Department of Biomedical Engineering, College of Medicine, The Catholic University of Korea,
[2]MR Team, Korea Basic Science Institute, Catholic Neuroscience Center, The Catholic University of Korea,
[3]Department of Ugurbil, Max-Planck Institute,
[4]Department of veterinary Surgery, College of Veterinary Medicine, Konkuk University

Abstract

In the preliminary study, we observed the alteration of choline signal intensity in hippocampus region of the depressive rat model induced by forced swimming test (FST). The purpose of this study was to evaluate the antidepressant efficacy in depressive animal model using MR spectroscopy. There were no differences in NAA/Cr and Cho/Cr ratio between the right and the left hippocampus both normal control rats and antidepressant-injected rats. Also, no differences were observed in NAA/Cr and Cho/Cr ratio between the normal control rats and the antidepressant-injected rats both the right and the left hippocampus. In this study, we found the recovery of choline signal in the depressive animal model similar to normal control groups as injecting desipramine-HCl which was antidepressant causing anti-immobility effects. Thus, we demonstrated that MR spectroscopy was able to aid in evaluating the antidepressant effect of desipramine-HCl.

P1-25 | p81-p83 | 5월 9일 | 2층 로비

열 치료용 비접촉식 광섬유 온도센서와 열원과의 관계 분석

서정기, 유욱재, 조동현, 장경원, 신상훈, 이봉수, 탁계래
건국대학교 의료생명대학 의학공학부, 의공학 실용기술 연구소

Analysis of Relationships between Heat Source and The Distal End of Noncontact Fiber-optic Temperature Sensor for Thermal Therapy

J. K. Seo, W. J. Yoo, D. H. Cho, K. W. Jang, S. H. Shin, B. Lee and G. R. Tack
School of Biomedical Engineering, Research Institute of Biomedical Engineering,
College of Biomedical & Health Science, Konkuk University

Abstract

In this study, we have fabricated a fiber-optic infrared radiation sensor with a silver halide optical fiber and thermopile sensor to measure temperature during the thermal therapy procedure. The measurable temperature range is 25～60 ℃ which includes the treatment temperature of thermal therapy. We have measured infrared radiations according to the distances and angles between the distal end of fiber-optic sensor and a heat source.

P1-26 | p84-p86 | 5월 9일 | 2층 로비

유기섬광 광섬유 방사선 센서를 이용한 치료용 근접 방사선원의 상대깊이선량율 측정

신상훈[1], 조동현[1], 장경원[1], 유욱재[1], 서정기[1], 이봉수[1], 문주현[2], 김신[3]
[1]건국대학교 의료생명대학 의학공학부, 의공학 실용기술 연구소, [2]동국대학교 에너지·환경대학 에너지·환경시스템학부,
[3]제주대학교 에너지공학과, 방사선 기술 연구소

Measurements of relative depth dose rates for a brachytherapy source using a fiber-optic organic scintillating radiation sensor

S. H. Shin[1], D. H. Cho[1], K. W. Jang[1], W. J. Yoo[1], J. K. Seo[1], B. Lee[1], J. H. Moon[2], and S. Kim[3]
[1]School of Biomedical Engineering, Research Institute of Biomedical Engineering,
College of Biomedical & Health Science, Konkuk University,
[2]Department of Energy & Environment system, Dongguk University,
[3]Department of Nuclear & Energy Engineering, Applied Radiological Science Research Institute, Cheju University

Abstract

In this study, we have fabricated a fiber-optic radiation sensor with an organic scintillating fiber for brachytherapy dosimetry. As a performance evaluation of a sensor tip, we have measured scintillating lights which are generated from various kinds of organic sensor tips irradiated by a brachytherapy source. Additionally, relative depth dose rates according to the depth of a PMMA phantom are measured.

P1-27 | p87-p89 | 5월 9일 | 2층 로비

자기공명분광분석법의 정도관리를 위한 장구형 팬톰의 개발

우동철[1], 김상수[2], 임향숙[2], 장건호[3], 백현만[4], O. Nalcioglu[4], 최치봉[1], 최보영[1]
[1]가톨릭대학교 의과대학 의공학교실, [2]분자생명의학과, [3]경희대학교 동서신의학병원 진단방사선과,
[4]John Tu and Thomas Center for Functional Onco-Imaging, University of Califorinia, Irvine, CA, USA

Quality assurance of 1H MR spectroscopy using a layered dumbbell shape phantom in clinical 3T system

D-C. Woo[1], S-S. Kim[2], H-S. Rhim[2], G-H. Jahng[3], H-M. Baik[4], O. Nalcioglu[4], C-B. Choi[1], B-Y. Choe[1]
[1]Department of Biomedical Engineering, College of Medicine, The Catholic University of Korea
[2]Department of Molecular Biology, College of Medicine, The Catholic University of Korea
[3]Department of Radiology, East-West Neo Medical Center, Kyung-Hee University
[4]John Tu and Thomas Center for Functional Onco-Imaging, University of Califorinia, Irvine, CA, USA

Abstract

For the performance evaluation of MR system, one-dimensional peak intensity of magnetic resonance spectroscopy (MRS) is more sensitive than the image contrast and resolution of MRI. The purpose of this study was to develop the standard MRS phantom, establish the quality assurance (QA) protocol with the principal factors and perform the QA of MR system. For the QA of MRS, seven principal factors (SNR, chemical shift, water suppression percent, line width, symmetry, VOI localization accuracy, VOI quantification accuracy) were suggested and measured. The layered dumbbell shape phantom was symmetrically designed to evaluate VOI localization accuracy and VOI quantification accuracy. Both the end sides were designed open to remove the air bubble and reduce the susceptibility artifact. The form of the phantom was made of acrylic resin and the layered dumbbell shape vial was filled with various metabolite materials (NAA, Cr, Cho and etc). All MRS QA factors of each MRI/MRS system were calibrated. The relationship between metabolite signal intensity and metabolite amount using our layered dumbbell shape phantom was established. The follow-up study showed that the QA factor values in Sep. 2007 was superior to that in Jun. 2007. We propose that the principal seven MRS QA factors can be used to evaluate MR spectra well as measure the stability of MR system like MRI QA protocol. The linearity between metabolite signal intensity and metabolite amount represents the relationship between VOI localization and quantification accuracy. The present follow up study revealed that MRI/MRS system or the operator's skill was improved after 3 months. If the database of QA protocols with 7 factors are fully established, this database can be used to guideline for QA/QC of MRI/MRS systems.

P1-28 | p90-p93 | 5월 9일 | 2층 로비

자기공명온도 영상에서의 위상펼침

TAN KEE CHIN[1], 김태형[1], 천송이[1], 이광식[2], 신운재[3], 은충기[4], 전제량[4], 문치웅[1]
[1]인제대학교 의용공학과, [2]부산백병원 영상의학과, [3]동의과학대학 방사선과, [4]인제대학교 의과대학 영상의학과 부산백병원

A Simplified MR Phase Unwrapping and Thermometry

K.C. Tan[1], T.H. Kim[1], S.I. Chun[1], K.S. Lee[2], W.J. Shin[3], C.K. Eun[4], J.R. Jun[4], and C.W. Mun[1]
[1]Dept. of Biomedical Engineering, Inje University
[2]Dept. of Medical Imaging Science, Pusan Paik Hospital
[3]Dept. of Radiology, Dong-Eui Institute of Technology
[4]Dept. of Radiology, Pusan Paik Hospital, Medical School, Inje University

Abstract

This paper presents a compact and novel self-developed algorithm for recovering the Magnetic Resonance (MR) absolute phase from the modulo-2π phase, the so-called phase unwrapping (PU) problem yet computing the temperature change and map thermal distribution. The proposed phase unwrapping method adopted the simple criterion of array-sequencing dependent on the phase values of images which eliminates the search for residues, placement of branch cuts, or generation of quality maps. As the phase will depend on the temperature, this will be utilized to compute the correspondence temperature maps. The program has been tested with both simulated and experimental data, yielding better results than some of the state-of-the-art methods. The algorithm was proved to be robust to noise and easier to be implemented.

P1-29 | p94-p95 | 5월 9일 | 2층 로비

저선량 CT를 이용한 폐기종 분석 도구 개발: 잡음 감쇄 필터에 의한 재현성 개선 연구

박상준[1,2], 이창현[3], 허창용[1,2], 김영재[2], 김광기[4], 김종효[1,2,3]
[1]서울대학교 의과대학 방사선응용생명과학, [2]서울대학교병원 방사선의학연구소, [3]서울대학교병원 영상의학과, [4]국립암센타 의공학과

Development of Quantitative Analysis Tool for Emphysema in LDCT: Reproducibility of Comparative Noise Filtering

S. J. Park[1,2], C. H. Lee[3], C. Y. Heo[1,2], J. Y. Kim[2], K. G. Kim[4], J. H. Kim[1,2,3]
[1]Interdisciplinary Programs in Radiation Applied Life Science Major, Seoul National University College of Medicine
[2]Institute of Radiation Medicine, [3]Department of Radiology, Seoul National University Hospital
[4]Department of Biomedical Engineering, Division of Basic & Applied Sciences, National Cancer Center, Gyeonggi-Do, Korea

Abstract

Computer aided three-dimensional densitometry of emphysema on low-dose chest Computed Tomography (CT) data can reduce workload and increase accuracy for radiologists evaluating follow-up CT scans. Reproducibility of the extent of emphysema is crucial. However, quantitative measurement of emphysema in low-dose CT images involves various sources of error and uncertainty due to noise, artifact, and changes of respiration. So we have developed a quantitative lung densitometry technique for emphysema with three-dimensional (3-D) approach. To illustrate performance of these techniques, we enrolled 15 patients from the outpatient department of pulmonology referred for non-contrast enhanced chest CT. Our proposed software calculated emphysema scores (ES) as percentage of total lung volume below -950 HU thresholds. ES were performed before and after applying noise reduction filters (clustering approach, median filter, and mean filter). Limits of agreement were determined with Bland-Altman approach. Results after denosing process are more reliable for evaluating reproducibility.

P1-30 | p96-p98 | 5월 9일 | 2층 로비

초음파 의료영상에서 Fourier Transform을 이용한 Digital Scan Conversion

안동기, 권성재, 정목근
대진대학교 전자공학과, 통신공학과

Digital Scan Conversion Using Fourier Transform in Medical Ultrasound Imaging

D. K. Ahn, S. J. Kwon, M. K. Jeong
Department of Electronics and Communications Engineering, Daejin University

Abstract

In a conventional digital ultrasound scanner, echo data are acquired in the polar coordinates, but should be displayed in the Cartesian coordinates in a raster format, which dictates a coordinate transformation process. The coordinate conversion process degrades image quality and results in artifacts. To address this problem, many studies have been done to interpolate pixels whose locations do not coincide with rectangular grid points. In this paper, we present a new method for digital scan conversion using Fourier transform in the spectral domain. In this method, scan conversion is accomplished in such a way that data in the cylindrical coordinates are converted to map onto the Cartesian coordinates while performing Fourier transform, and then the Cartesian coordinate data are inverse Fourier transformed. The proposed method was applied to medical ultrasound images, and was found by computer simulation to produce nearly identical results compared to the well-known bilinear interpolation method.

P1-31 | p99-p102 | 5월 9일 | 2층 로비

컴프턴 카메라에 대한 분산감소 정규화 기법에 관한 연구

김수미[1,2], 이재성[2], 김중현[1,2]
[1]서울대학교 방사선응용생명과학 협동과정, [2]핵의학교실

Study of Variance-Reduction Normalization Method for Compton Camera System

S. M. Kim[1,2], J. S. Lee[2], J. H. Kim[1,2]
[1]Interdisciplinary Programs in Radiation Applied Life Science Major,
[2]Department of Nuclear Medicine, Seoul National University

Abstract

The variance-reduction method for a Compton camera which is a normalization method to correct the non-uniformity of detection was studied. For the variance-reduction method, the Compton list-mode data of a planar source were generated from GATE that is a Monte Carlo (MC) simulation tool based on Geant4.The generated data were binned and used to estimate a normalization coefficient for a bin. Using the projector, the Compton projection data were generated for a cylindrical phantom with 5-cm in diameter and length. The normalization was applied to the Compton projection data prior to reconstruction and then the normalized data were reconstructed by ordered subset expectation maximization algorithm. The reconstructed images and the coefficient of variations show that the non-uniformity of detection is directly propagated into the reconstructed image and the variance-reduction method improves the statistical quality in the Compton data.

P1-32 | p103-p106 | 5월 9일 | 2층 로비

펄스 반전 칼라 플로우 영상을 위한 π-초기화 IIR 필터를 이용한 클러터 제거 기법

이재진, 강현, 송재희, 송태경
서강대학교 의공학 기술 연구 센터

Clutter rejection methods using a π-initialization IIR filter for pulse-inversion color flow imaging

J. J. Lee, H. Kang, J. H Song, T. K Song
Center for Medical Solutions Research, Sogang University

Abstract

We propose efficient clutter filtering methods to increase the detectable Doppler frequency range in pulse inversion color flow imaging. The proposed π-initialization IIR filter can reject more effectively the clutter in a wider cutoff frequency range than the conventional filters. The proposed technique can also minimizes the transient response of an IIR filter to remove the clutter signal centered at half the pulse repetition frequency (PRF) due to the pulse inversion scheme. Computer simulation results show that the π-initialization IIR filter provides almost the same performance as a projection initialization IIR filter, with a reduced computational complexity.

P1-33 | p107-p110 | 5월 9일 | 2층 로비

하모닉 직교 복조 방식을 이용한 고조파 골레이 코드 여기 기법

김상민, 송재희, 송태경
서강대학교 의공학 기술 연구센터

Harmonic golay coded excitation using harmonic quadrature demodulation scheme

S. M. Kim, J. H. Song, T. K. Song
Center for Medical Solutions Research, Sogang University

Abstract

Harmonic coded excitation techniques have been used to improve SNR decreasing MI. However, harmonic golay coded excitation techniques need four transmit-receive events, leading to a low frame rate. To overcome this problem, the method to increase the fram rate without deteriorating image quality is proposed in this paper. The proposed method uses the QPSK transmit code to make the received harmonic components have the property of golay codes and employs the harmonic quadrature demodulation method to separate the second harmonic component and the fundamental component. The validity of the proposed method is verified analytically and also by MATLAB simulation.

P1-34 | p111-p114 | 5월 9일 | 2층 로비

행작용 방법을 사용한 스플라인으로 정칙화된 최대우도 영상재구성

Van-Giang Nguyen, 이수진
배재대학교 전자공학과

Spline-Regularized ML Image Reconstruction Using Row-Action Methods

Van-Giang Nguyen and Soo-Jin Lee
Department of Electronic Engineering, Paichai University

Abstract

In this paper we investigate performance of regularized maximum likelihood (ML) reconstruction methods for emission tomography. The algorithms considered here are based on the spline-regularized ML using row-action methods, which deal with only one row of the system matrix at a time so that consecutive rows are as orthogonal as possible. These methods are known to converge to the true solution much faster than the conventional regularized ML based on the famous expectation maximization (EM) algorithm. We show that, with the proposed methods, our previously developed convex non-quadratic priors can be more practical by improving the convergence speed as well as the stability of the algorithm. The experimental results indicate good performance of our algorithms for more realistic phantoms.

P1-35 | p115-p117 | 5월 9일 | 2층 로비

휴대용 초음파 영상장치를 위한 TMS320C6416기반의 후단신호처리 시스템의 설계 및 구현

권오현, 손학렬, 송태경
서강대학교 공과대학 전자공학과

A Back-end Signal Processing System Based on a Single TMS320C6416T for Portable Ultrasound Imaging

O. H. Kwon, H. Y. Sohn, and T. K. Song
Department of Electronic Engineering, College of Engineering, Sogang University

Abstract

The interest for hand-held medical diagnosis devices has been increasing because they are able to provide patient-oriented medical service. For such an application, development of a small and low-power diagnosis device is of crucial importance. Especially, a portable ultrasound imaging system using a commercial digital signal processor has advantages over the conventional hardware-based system in terms of development cost and time. We have recently implemented the whole back-end part of an ultrasound system, including echo-processor, color flow and digital scan converter. For real-time implementation, most functional blocks are optimized to best utilize the DSP architecture and coded in the assembly language.

P1-36 | p118-p120 | 5월 9일 | 2층 로비

흉부 CT 영상에서의 형태학적 기법을 이용한 Honeycombing 자동검출

김영재[1], 박상준[1], 김광기[2], 허창용[1], 김종효[1]
[1]서울대학교병원 방사선의학연구소, [2]국립암센타 의공학과

Automatic Segmentation of Honeycombing Lesions with Morphological-based Method in Chest CT Images

Y. J. Kim[1], S. J. Park[1], K. G. Kim[2], C. Y. Heo[1], J. H. Kim[1]
[1]Institute of Radiation Medicine, Seoul National University Hospital
[2]Department of Biomedical Engineering, Division of Basic & Applied Sciences, National Cancer Center, Gyeonggi-Do, Korea

Abstract

Honeycombing is a cluster of cysts. Each cyst is sized of 2-10mm, and surrounded with walls. The walls are composed of dense fibrous tissues. Honeycombing in the lung is an important diagnostic sign for diseases including fibrosis of the lung. In our study, we tried to experiment with 83 cases for detecting air cyst and honeycombing lesions and evaluate accuracy of our proposed morphological-based technique.

P1-37 | p121-p124 | 5월 9일 | 2층 로비

A Novel Method for Correction of Digital Image Distortion

Mohammad Abu yousuf, 최정민, 조민형, 이수열,
경희대학교 동서의료공학과

A Novel Method for Correction of Digital Image Distortion

M. A. Yousuf, J. M. Choi, M. H. Cho and S. Y. Lee
Department of Biomedical Engineering, Kyung Hee University, Republic of Korea

Abstract

This paper presents an efficient method for correcting the radial distortion in digital images. One of the most common image distortions seen through a lens is radial distortion. This occurs because the magnification of the lens is different at the edge of the lens versus the center of the lens. The effect of radial distortion is that straight lines are bent as the image formation in a pixel is shifted away from its original position. In this paper Polynomial Model (PM) is used to describe radial distortion. The radial distortion is corrected by first applying parametric radial distortion model, then estimating the distortion coefficients and finally correcting the distortion. To validate our method we applied this method to photographic images. In all cases, our method produces nearly undistorted images even though the acquired images were strongly distorted.

P1-38 | p125-p127 | 5월 9일 | 2층 로비

AR 및 DSP 방법을 이용한 다중 동위원소 감마카메라 영상의 혼선 보정

박민재, 이재성, 박광석
서울대학교 협동과정 의용생체공학전공
서울대학교 의과대학 핵의학교실

Crosstalk correction of dual isotope gamma camera image using AR and DSP method

M. J. Park, J. S. Lee, and K. S. Park
Interdisciplinary Program in Medical and Biological Engineering Major, Seoul National University
Department of Nuclear Medicine, Seoul National University Hospital

Abstract

To correct crosstalk on dual isotope images, impulse response of 140KeV and 159KeV are simulated on the validated Triad SPECT camera with LEUHR collimator. Two kinds of methods are evaluated: accumulating ratio [AR] and direct subtracted projection [DSP] method. AR method is processed on list-mode data based on that each probability of total is same as summation of probability. DSP method is processed on two photopeak-energy windows based on that ratios between energy windows are fixed. Gaussian fitted counts are compared for the separation performance. DSP method shows almost perfect separation.

P1-39 | p128-p130 | 5월 9일 | 2층 로비

Conductivity Imaging of Postmortem Swine Legs using MREIT

A. S. Minhas, 김형중, 김영태, 정우철, 우응제
경희대학교 동서의료공학과

Conductivity Imaging of Postmortem Swine Legs using MREIT

A. S. Minhas, H. J. Kim, Y. T. Kim, W. C. Jeong, and E. J. Woo
Department of Biomedical Engineering, Kyung Hee University, Korea

Abstract

Magnetic Resonance Electrical Impedance Tomography (MREIT) provides cross-sectional images of conductivity distribution σ inside an imaging subject. In MREIT, we scan the subject using an MRI scanner while injecting current through surface electrodes in two mutually orthogonal directions. The current injection changes the phase of the MR image due to the induced magnetic flux density distribution inside the subject. We can obtain the z- component B_Z of the magnetic flux density using the MRI scanner. Based on the relation between $\nabla^2 B_Z$ and $\nabla\sigma$, the harmonic B_Z algorithm reconstructs the conductivity distribution σ inside the subject. In this work, we have used the MREIT technique to reconstruct conductivity images inside three postmortem swine legs. The conductivity images show a perceivable contrast among different muscles and their boundaries. The conductivity ofthe bone marrow is also distinguishable from the bone structure.

P1-40 | p131-p134 | 5월 9일 | 2층 로비

DT-MR 영상에서 Successive Fermat 방법을 이용한 정규화에 관한 연구

김태환[1], 권기운[1], 정재원[1], 박인성[1], 한봉수[2], 김동윤[1]
[1]연세대학교 보건과학대학 의공학과, [2]방사선학과

A Study on the Successive Fermat Method for the Regularization of the DT-MR images

T. H. Kim[1], K. W. Kwon[1], J. W. Jeong[1], I. S. Park[1], B. S. Han[2], D. Y. Kim[1]
[1]Department of Biomedical Engineering, Yonsei University
[2]Department of Radiological Science, Yonsei University

Abstract

Tractography using Diffusion Tensor Magnetic Resonance Imaging (DT-MRI) is a method to determine the architecture of axonal fibers in the central nervous system by computing the direction of the principal eigenvector in the white matter of the brain. However, the fiber tracking methods suffer from the noise included in the diffusion tensor images that affects the determination of the principal eigenvector. To reduce the noise in DT-MRI measurements, a tensor-valued median filter which is reported to be denoising and structure-preserving in fiber tracking, is applied in the tractography.

In this paper, we proposed the Successive Fermat method which successively uses Fermat point theory for a triangle contained in the two-dimensional plane. For the corticospinal tract, the proposed method achieved 16.27%, 20.78%, and 14.45% less error than the noisy image for error measures AE, AAE, AFA respectively.

P1-41 | p135-p137 | 5월 9일 | 2층 로비

Hessian Matrix를 이용한 맘모그램의 미세석회화 군집 자동 검출 시스템

이화정, 김종효, 이준구
서울대학교 의과대학 방사선응용생명과학 협동과정

Computer-Aided Diagnosis System Using Hessian Matrix For Auto Detection of Microcalcification Clusters in Mammograms

H.J. Lee, J.H Kim, J.G Lee
Interdisciplinary Program in Radiation Applied Life Science, College of Medicine, Seoul National University

Abstract

Mammography is considered the most effective method for early detection of breast cancers. However, it is difficult for radiologists to detect microcalcification clusters. Therefore, we have developed a computerized scheme for detecting early-stage microcalcification clusters in mammograms. we used 25 clinical cases with microcalcifications. Classified regions were color mapped and compared to the mask images drawn by clinician. our approach shows good performance. Our computerized scheme was shown to have the potential to detect microcalcification clusters with a clinically acceptable sensitivity and low false positives.

P1-42 | p138-p141 | 5월 9일 | 2층 로비

Magnetic Nevigation of a Ferromagnetic Core Using MRI Gradient Coils

Koushik Kanti Mandal, 한병희, 강래훈, 하용현, 조민형, 이수열
경희대학교 동서의료공학과

Magnetic Navigation of a Ferromagnetic Core Using MRI Gradient Coils

Koushik Kanti Mandal, Byung Hee Han, Laehoon Kang, Yong-Hyun Ha, Min Hyoung Cho, Soo Yeol Lee
Dept. of Biomedical Engineering, Kyung Hee University, Korea

Abstract

The feasibility tests and results for magnetic navigation of a ferromagnetic sphere using MRI gradients have been presented in this study. The magnetic force for the propulsion of the sphere is produced by the three linear gradients of MRI. We first calculatedthe magnetic force maps for well known gradient coil configurations, the Maxwell coil in the z-direction and the Golay coil in the x- and y-direction. We have found that the MRI gradient coils can be used for three dimensional navigation of the magnetic device if the concomitant gradient effects are corrected. We have performed magnetic propulsion experiments using the small scale gradient coils and the large scale gradient coils of 3.0 T MRI system.

P1-43 | p142-p145 | 5월 9일 | 2층 로비

Maxwell 코일을 이용한 자기 추력에 관한 연구

하용현, 한병희, 강래훈, K. K. Mandal, 조민형, 이수열
경희대학교 전자정보대학 동서의료공학과

A Study on Magnetic Propulsion using a Maxwell Coil

Y.-H. Ha, B. H. Han, L. H. Kang, K. K. Mandal, M. H. Cho, S. Y. Lee
Department of Biomedical Engineering, Kyung Hee University, Republic of Korea

Abstract

The Maxwell coil is a widely used gradient coil for MRI. The Maxwell coil can be used for magnetic propulsion of a magnetic sphere in a living subject. Although the Maxwell coil produce quite uniform gradient field in the middle of the coil, it has non-negligible concomitant gradients in the peripheral region which may cause navigation errors when the Maxwell coil is used for the magnetic propulsion along the z-direction. In this paper, we have calculated the magnetic force exerted by the Maxwell coil and verified the calculation with experiments.

P1-44 | p146-p148 | 5월 9일 | 2층 로비

MR 영상을 이용한 20대, 40대 정상 한국인의 안와 부피 계측

이수정[1], 김기연[1], 최미현[1], 이봉수[1], 이법이[2], 정순철[1]
[1]건국대학교 의학공학부, [2]건국대학교 해부학교실

Measurement of Orbit Volume of 20s and 40s Korean People

S. J. Lee[1], G. Y. Kim[1], M. H. Choi[1], B. Lee[1], B. Y. Lee[2], S. C. Chung[1]
[1]Department of Biomedical Engineering, Konkuk University
[2]Department of Anatomy, College o f Medicine, Konkuk University

Abstract

본 연구에서는 MR 영상을 이용하여 20대와 40대 정상 한국 성인의 안와(orbit) 부피를 측정하였다. 20대 71명 (남자 32명, 여자 39명)과 40대 72명 (남자 30명, 여자 42명), 총 143명을 대상으로 MR 뇌 영상을 획득하였다. 20대와 40대 한국인의 안와 부피의 평균은 20.35±2.05[cm^3]이었다. 20대 안와 부피 평균은 21.36±1.63[cm^3]이고 40대 안와 부피 평균은 19.35±1.94[cm^3]로서 40대에 비해 20대의 안와의 부피가 더 컸다. 남자는 21.50±1.72[cm^3]이고 여자는 19.47±1.84[cm^3]로서 여자에 비해 남자의 안와 부피가 더 컸다.

P1-45 | p149-p152 | 5월 9일 | 2층 로비

MREIT 영상의 개선을 위한 탄소-Hydrogel 전극

정우철, 김영태, A. S. Minhas, 김형중, 우응제
경희대학교 동서의료공학과

Carbon-Hydrogel Electrode for MREIT

W. C. Jeong, Y. T. Kim, A. S. Minhas, H. J. Kim and E. J. Woo
Department of Biomedical Engineering, Kyung Hee University, Korea

Abstract

Magnetic resonance electrical impedance tomography (MREIT) is a high-resolution conductivity imaging technique. In MREIT, a subject is scanned in an MRI scanner while injecting current through surface electrodes. Electrode shape, size and design greatly affect the experimental procedure and image quality. Earlier studies in MREIT have used TX-151 recessed electrodes. However, this type of electrode is not suitable for human experiments because it is rigid and cannot cover a larger surface area. In the present work, we suggest a flexible carbon-hydrogel electrode which can inject a larger current through an increased surface area leading to a much smaller current density underneath the electrode. We tested 3 different types of electrodes including carbon only, carbon-hydrogel and traditional TX-151electrodes. The carbon only electrode had larger artifacts in MRI phase image and hence is discarded from further use. Our results suggest the use of carbon -hydrogel electrodefor human experiments. Humansubjects may endure a larger current with these electrodes and this will be beneficial in MREIT due to an increased SNR.

P1-46 | p153-p156 | 5월 9일 | 2층 로비

MRI를 이용한 자성체의 위치 추적

강래훈, 한병희, 하용현, K. K. Mandal, 조민형, 이수열
경희대학교 전자정보대학 동서의료공학과

Positioning and Tracking of a Ferromagnetic Core using MRI

L. H. Kang, B. H. Han, Y. H. Ha, K. K. Mandal, M. H. Cho, and S. Y. Lee
Department of Biomedical Engineering, Kyung Hee University, Republic of Korea

Abstract

Magnetic propulsion of an un-tethered device in a living subject becomes of great interest due to the its wide applicability in the clinical fields. In this paper, a novel method for positioning and tracking of a ferromagnetic core using MRI is proposed. MR images of a phantom containing a ferromagnetic sphere in it have been obtained with various kinds of imaging sequences. The position of the ferromagnetic core has been calculated from the MR images which have the susceptibility artifacts caused by the magnetic sphere. We have compared the positioning errors among the images obtained with the imaging sequences.

P1-47 | p157-p159 | 5월 9일 | 2층 로비

Non-Cartesian k-space 샘플링을 이용한 3차원 자기공명영상 복원

고성민, 조상영, 김동현
연세대학교 전기전자공학과

3D MRI Reconstruction using Non-Cartesian k-space sampling

S. M. Gho, S. Y. Zho, D. H. Kim
School of Electrical and Electronic Engineering, Yonsei University, Seoul, Korea

Abstract

Reconstructing MR (magnetic resonance) images acquired from non-cartesian sampled k-space continues to be a very important research topic. One well known method is the conventional gridding algorithm. But, this algorithm has a very difficult process of finding the appropriate density compensation function (DCF). To avoid this process, a simple iterative algorithm, namely a deconvolution-interpolation gridding (DING) has previously been presented.

In this abstract, we expand DING for three dimensional applications and compare the performance of 3D DING and 3D conventional gridding algorithm. Using root mean square criteria and simulated samples obtained from random k-space trajectories, we show that DING is robust to SNR.

P1-48 | p160-p163 | 5월 9일 | 2층 로비

RF Shimming을 이용한 B_1^+ Field 균일도 개선

오정욱, 허혜영, 한병희, 조민형, 이수열
경희대학교 동서의료공학과

Improvement of B_1^+ Field Uniformity using RF Shimming

J.W. Oh, H.Y. Heo, B.H. Han, M.H. Cho and S.Y. Lee
Department of Biomedical Engineering, Kyung Hee University, Korea

Abstract

According that recent the high-field MRI have been designed, several methods have been proposed for overcoming the effects of B_1^+ field inhomogeneity. Some of these methods control magnitude and phase of different arrays in RF coils. The adjustment of these array magnitudes and phases alone to create uniform B_1^+ field(RF magnetic field) has been called RF shimming, and has certain limits at every frequency as dictated by possible solutions to Maxwell's equations.

Here we simulate to explore the effect of RF shimming in the human head. We confirmed that 16-element array can effectively shim at 300MHz rather than at 600MHz. We also found that we can get more homogeneous B_1^+ field at low frequency.

P1-49 | p164-p166 | 5월 9일 | 2층 로비

고주파 열처리 실험을 위한 시스템 개발

강동원, 방윤환, 최진승, 이봉수, 탁계래
건국대학교 의학공학부

Development of experimental system of hepatic malignancies using radio-frequency thermal ablation

D. W. Kang, Y. H. Bang, J. S. Choi, B. S. Lee, G. R. Tack
Department of Biomedical Engineering, Konkuk University

Abstract

Radio-frequency(RF) thermal ablation is one of the most promising minimally invasive techniques for the treatment of nonresectable hepatic tumors. To date, liver tumor ablation has received the greatest attention and has been the subject of a large number of published reports. Most studies analyzed temperature distribution of tumor ablation using FEM(finite element method) or visualizing analysis(etc. CT, MRI). But results of these studies can appear different results in realistic environment. So, we developed experimental system device for verification of radio-frequency thermal ablation. This system was applied to realistic environment setting of human body temperature. This system will be used for the verification of finite element analysis for further study.

P1-50 | p167-p169 | 5월 9일 | 2층 로비

중풍 동물모델에서 실시간 관찰을 통한 한방 침 지료에 따른 신경전달물질의 변화 연구

이기자[1,2], 어윤혜[1,2], 임지은[1,2], 최석근[3], 인창식[4], 박지혜[1,2], 박형준[1,2], 오범석[1,2,5], 박헌국[1,2,5]
[1]경희대학교 의과대학 의공학과, [2]경희대학교 의료산업연구원, [3]경희의료원 신경외과,
[4]경희대학교 침구경락과학연구센터, [5]경희대학교 생체의과학 협동과정

A real-time monitoring of neurotransmitter in rat ischemia model treated by Korean acupuncture

G. J. Lee[1,2], Y. H. Eo[1,2], J .E. Lim[1,2], S. K. Choi[3], C. S. Yin[4], J .H. Park[1,2], H. J. Park[1,2], B. S. Oh[1,2,5] and H. K. Park[1,2,5]
[1]Dept. of Biomedical Engineering, College of Medicine, Kyunghee University,
[2]Healthcare Industry Research Institute, Kyunghee University,
[3]Dept. of Neurosurgery, Kyunghee University Medical Center,
[4]Acupuncture and Meridian Science Research Center, Kyunghee University,
[5]Program of Medical Engineering, Kyunghee University

Abstract

It is generally thought that cerebral ischemia is associated with extracellular concentrations of the excitatory amino acids. Over secreted L-glutamate linked to the neuronal cell death in ischemic conditions.

Stroke has been traditionally treated with acupuncture in Korea known as a physiiological therapeutic modality. Real time quantitative measurement of glutamate would be very helpful for evaluation brain injury during or after surgery, as well as validation of the rapid effect of acupuncture.

For real-time in-vivo glutamate measurements, we prepared the eleven vessel occlusion (11VO) in rat model. Changes in cerebral cortical blood flow were monitored by laser-Doppler flowmetry simultaneously with cortical glutamate levels by amperometric biosensor. A ten minute 11VO cerebral ischemia was initiated by pulling the snares on the common carotid arteries (CCAs) and the external carotid arteries (ECAs). Acupuncture at the acupoints of bilateral GB34 and GB39 based on the classical literature, was conducted during the ischemic period for 10 min.

In comparison with the acupuncture and non-acupuncture group, peak concentration and the area under the curve AUC) of glutamate release showed statistically significant difference between two groups. It is considered that the decrease of extracellular glutamate level in acupuncture group is attributed to neuroprotective effect by acupuncture.

P1-51 | p170-p173 | 5월 9일 | 2층 로비

진동 및 전기 자극을 사용한 근 방추의 운동조절 공헌에 관한 실험 및 컴퓨터 시뮬레이션 스터디

유두희[1], Naoyuki Murakami[2], Shinsuke Yoshioka[2], Junichi Ushiyama[3], Senshi Fukashiro[1]
[1]Graduate School of Interdisciplinary Information Studies, University of Tokyo, Tokyo, Japan,
[2]Dept. of Life Sciences, University of Tokyo, Tokyo, Japan,
[3]Institute of Physical Education , Keio University, Tokyo, Japan

Computer simulation and experimental study of muscle spindles contribution to human performance control using prolong mechanical vibration and electrical stimuli

D.H You[1], Naoyuki Murakami[2], Shinsuke Yoshioka[2], Junichi Ushiyama[3], Senshi Fukashiro[1]
[1]Graduate School of Interdisciplinary Information Studies, University of Tokyo, Tokyo, Japan,
[2]Dept. of Life Sciences, University of Tokyo, Tokyo, Japan,
[3]Institute of Physical Education , Keio University, Tokyo, Japan

Abstract

The purpose of this study was to examine the influence of muscle spindles in dynamic human movement. Ⅰ. Prolonged vibration stimulus was conducted on the H reflex during subjects performed dynamic movement before and after vibration stimuli to see the change of muscle spindle sensitivity intended by vibration stimuli. Changed in performance were determined by jump height, GRF and EMG data. Ⅱ. Experimental data were applied as inputs for the muscle spindle model in order to estimate the effect of sensitivity change on the performance of dynamic movement. Estimation of the sensitivity of muscle spindle to various vibration stimuli and the resultant effects on muscle contraction is a useful step in understanding the complex phenomenon of human movement in peripheral level.

P1-52 | p174-p176 | 5월 9일 | 2층 로비

Heat-mapping 기법을 이용한 가상공간에서의 공간적 head-gaze 분석 방법 개발: 예비연구

한기완[1], 구정훈[1], 신영석[1], 김진률[1], 박진식[1], 이형래[1], 김영수[2], 김인영[1], 김선일[1]
[1]한양대학교 의용생체공학과, [2]한양대학교 의과대학 신경외과학교실

Development of Analysis Method for Spatial Head-gaze in Virtual Environments using Heat-mapping Technique: Pilot Study

K. W. Han[1], J. H. Ku[1], Y. S. Shin[1], J. R. Kim[1], J. S. Park[1], H. R. Lee[1], Y. S. Kim[2], I. Y. Kim[1] and S. I. Kim[1]
[1]Department of Biomedical Engineering, Hanyang University, Seoul, Korea,
[2]Department of Neurosurgery, College of Medicine, Hanyang University, Seoul, Korea

Abstract

Virtual reality is media that present virtual environment using the computer graphic and human computer interaction. The use of virtual reality to communicate and interact have been becoming common in the industry, military, education, and entertainment field, because a user can navigate freely around the virtual environment and interact with virtual objects that they encounter. Furthermore, the virtual reality has been used very effectively in the medical field, particularly psychiatric treatment in cognitive behavioral therapy. In cognitive behavioral therapy spatial gaze is one of the most important parameter with time, frequency, and distance to present attention, perception, and do on. In this paper, we developed a quantitative analysis method for spatial eye-gaze in virtual environments using heat-mapping technique with Gaussian kernel smoothing for understanding human cognitive behavioral characteristics.

P1-53 | p177-p179 | 5월 9일 | 2층 로비

HRV 신호을 이용한 통증 측정에 관한 연구

박정훈[1], 이우철[2]
[1]안동과학대학 의료공학과, [2]을지대학교 의료공학과

Pain Measurement using HRV Signal

J. H. Park[1], W. C. Lee[2]
[1]Department of Biomedical Engineering, Andong Science College,
[2]Department of Biomedical Engineering, Eulji University

Abstract

The purpose of this paper was to investigate the pain after abdominal section using surface EMG and heart rate variability(HRV). Surface EMG can pain point monitoring which muscles are active and the relationship between a level of activity. A computer-based corrugator supercilii muscle evaluation system and ECG signal was designed to simultaneously acquire, process, display. With a more traditional measure of overall variability(standard deviation, mean, spectral values of heart rate), nonlinear characteristics of HRV signal were analyzed using Pointcare plot.

P1-54 | p180-p181 | 5월 9일 | 2층 로비

ISO 14971을 적용한 HEMODIALYZER 투석액 흐름의 측정오류에 대한 RISK MANAGEMENT에 관한 연구

전석봉[1], 문경석[1], 김승엽[1], 김홍규[1], 채영한[1], 이호석[1], 권혁남[1], 김병태[2]
[1]삼성서울병원 의공학과, [2]성균관대학교 의과대학

A study on a risk management of measurement errors of hemodialysis fluid flow using ISO 14971

S.B. Jeon[1], K.S Moon[1], S.Y. Kim[1], H.K. Kim[1], Y,H Chae[1], H.S Lee[1], H.N. Kwon[1], B.T. Kim[2]
[1]Department of Biomedical Engineering, Samsung Medical Center
[2]Sungkyunkwan University School of Medicine

Abstract

As the life style and dietarylife of human beings is changed by the modern society's development, the number of patient who needs hemodialysis treatment with damaged glomeruluses by the toxin originate from those new life style is increasing highly. Even those patients can keep a safe and regular life with a risk management for an accurate hemo-dialysis.

In that reason, we've studied on a risk management of dialysis dose with ISO 14971. And we would present the case study which adopted effective and optimized method in this paper.

P1-55 | p182-p186 | 5월 9일 | 2층 로비

건강 증진과 개인별 진단이 가능한 통합형 정보 시스템

사디아 말릭, 박승훈
경희대학교 전자정보대학 동서의료공학과

An Integrated Information System For Health Improvement And Counselling

S. Malik and S. H. Park
Dept. of Biomedical Eng. College of Electronics and Information Kyung Hee University

Abstract

Fitness and diet reporting and counseling involves heterogeneous users to interact and collaborate in distributed settings. However, concerned users require a seamless, one-stop collaboration mechanism which can enable them to easily interact and pursue their health concerns. Providing such facility is hindered mainly due to inherently diversified data requirements because of different roles and modes of operation. In this work, we propose an integrated web-based health promotion system responsible for supporting and addressing different aspects of requirements for efficient and effective conversation between a complex chain of healthcare bodies and their concerning patients.

P1-56 | p187-p190 | 5월 9일 | 2층 로비

일일 건강측정과 멘토링을 통한 생활습관 교정의 건강 증진 시스템

이고은, 김현숙, 장대근, 서상진, 박승훈
경희대학교 전자정보대학 동서의료공학과

Health Promotion System through Life-style Correction with Daily Check up and Mentoring

G. E. Lee, H. S. Kim, D. G. Jang, S. J. Seo and S. H. Park
Dept. of Biomedical Eng. College of Electronics and Information, Kyung Hee University

Abstract

In this paper, we present an environment where patients can correct unhealthy lifestyle via health management system with daily check up and a web-based system with mentoring. Our proposed architecture consists of two fundamental systems, the health management system and the mentoring system.

The health management system provides main services with patients to measure physiological parameters such as body weight, percent body fat, blood pressure and blood glucose. After that, an analytical description is offered to the patients to monitor the current state of body via a graph of cumulative results. Besides, our proposed health management system can patternize the lifestyle using the questionnaires about lifestyle. These results are displayed in a graphical form describing the differences between general lifestyle and their lifestyle. The patients are offered the aids to improve the lifestyle in aggressive habits, quit drinking and smoking.

The mentoring system based on the web environment stores the measured physiological parameters and the results of questionnaire so that guardian can take care of the dependency patient every time and every place. It will be able to relieve guardian's concern due to the intervention role.

P1-57 | p191-p194 | 5월 9일 | 2층 로비

재택건강관리시스템 환경에서 응급 구조사를 위한 PDA컨텐츠 구성

심 훈[1,2], 김효민[1,2], 송상하[1,2], 이정훈[1,2], 이주환[1,2], 윤영로[1,2]
[1]연세대학교 대학원 의공학과, [2]재택건강관리시스템 연구센터

Development of PDA contents for rescue team under Home Healthcare Management System environment

H. Shim[1,2], H. M. Kim[1,2], S. H. Song[1,2], J. H. Lee[1,2], J. H. Lee[1,2], Y. R. Yoon[1,2]
[1]Department of Biomedical Engineering, Yonsei University, [2]Home Healthcare Management System Research Center

Abstract

In this study, PDA application program was developed which integrates Home Healthcare Management System Research Center(H^2MRC) and the role of rescue team. This approach maybe useful to rescue team wishing to know health state of a patient in emergency. We suggests basic information and database for the purpose of encourage a survival rate of patients.

P1-58 | p195-p198 | 5월 9일 | 2층 로비

정상 및 종양 유방조직의 도전율 측정

이대현[1], 송형근[2], 우응제[1]
[1]경희대학교 전자정보대학 동서의료공학과, [2]충북대학교의과대학 병리학교실

Conductivity Measurement of Normal and Tumor Breast Tissues

D. H. Lee[1], H. G. Song[2], and E. J. Woo[1]
[1]Department of Biomedical Engineering, Kyung Hee University, Korea
[2]Department of Pathology, Chungbuk National University

Abstract

Breast cancer is the second most common cancer among women. It is becoming a major concern among female patients. There is known that a substantial conductivity difference exists between a tumor and normal breast tissues. This may provide a conductivity-based diagnostic technique for breast cancer detection. The present work reports measured conductivity values of breast tissues collected from 7 different patients. Each set of tissues comprised a normal and a breast cancer tissue from the same patient. We designed a measuring chamber for tissue placement, current injection and voltage measurement. The tissue was placed in the chamber, electrodes were attached to the tissue and a BIS (Bio-Impedance Spectroscopy) system was used to measure its impedance. We measured the length of the tissue inside the chamber. The area was the cross-sectional area of the cylindrical chamber. From these data, we could get the conductivity value of the tissue. The results show a recognizable difference between normal and breast tumor tissues. The future work will include repeated experiments using more number of samples. Further experimentation and better design of the BIS system in terms of SNR and sensitivity will be pursued.

P1-59 | p199-p202 | 5월 9일 | 2층 로비

Human Activity Recognition Using Augmented Autoregressive Model Coefficients from a Triaxial Accelerometer Signal

아딜 메무드 칸[1], 이영구[1], 김태성[2]
[1]경희대학교 전자정보대학 컴퓨터공학과, [2]경희대학교 전자정보대학 동서의료공학과,

Human Activity Recognition Using Augmented Autoregressive Model Coefficients from a Triaxial Accelerometer Signal

A. M. Khan[1], Y. K. Lee[1], T.-S. Kim[2]
[1]Department of Computer Engineering, [2]Department of Biomedical Engineering, Kyung Hee University, South Korea

Abstract

Automatic recognition of human activities is one of the important and challenging research areas in proactive and ubiquitous computing. In this work, we present some preliminary results of recognizing human activities using augmented features extracted from the activity signals measured using a single triaxial accelerometer sensor and artificial neural nets. The features include autoregressive (AR) modeling coefficients of activity signals, signal magnitude areas (SMA), and title angles (TA). We have recognized four human activities using AR coefficients (ARC) only, ARC with SMA, and ARC with SMA and TA. With the last augmented features, we have achieved the recognition rate above 99% for all four activities including lying, standing, walking, and running. With our proposed technique, real time recognition of some human activities is possible.

P1-60 | p203-p206 | 5월 9일 | 2층 로비

Independent Component Feature-based Human Activity Recognition via Linear Discriminant Analysis and Hidden Markov Model

엠디 지아 우딘, 이지준, 김태성
경희대학교 전자정보대학 동서의료공학과

Independent Component Feature-based Human Activity Recognition via Linear Discriminant Analysis and Hidden Markov Model

Md. Zia Uddin, J. J. Lee, and T.-S. Kim
Dept. of Biomedical Engineering, College of Electronics and Information, Kyung Hee University

Abstract

In proactive computing, human activity recognition from image sequences is an active research area. This paper presents a novel approach of human activity recognition based on Linear Discriminant Analysis (LDA) of Independent Component (IC) features from shape information. With extracted features, Hidden Markov Model (HMM) is applied for training and recognition. The recognition performance using LDA of IC features has been compared to other approaches including Principle Component Analysis (PCA), LDA of PC, and ICA. The preliminary results show much improved performance in the recognition rate with our proposed method.

P1-61 | p207-p209 | 5월 9일 | 2층 로비

금속 나노선 구조를 이용한 고감도 표면 플라즈몬 공명 이미징 바이오센서에 관한 연구

변경민[1], 윤순준[2], 김동현[2]
[1]경희대학교 전자정보대학 동서의료공학과, [2]연세대학교 공과대학 전기전자공학부

Highly Sensitive Surface Plasmon Resonance Imaging Biosensors with Metallic Nanowires

K. M. Byun[1], S. J. Yoon[2], and D. Kim[2]
[1]Department of Biomedical Engineering, Kyung Hee University,
[2]School of Electrical and Electronic Engineeting, Yonsei University

Abstract

A nanowire-mediated surface plasmon resonance (SPR) imaging is numerically investigated for enhanced sensitivity. The results calculated by rigorous coupled-wave analysis present that interactions between localized surface plasmons and surface plasmon polaritons contribute to sensitivity enhancement. Compared to conventional SPR imaging measurement, an optimal nanowire structure can provide sensitivity enhancement by 3.44 times as well as highly linear detection property for quantification of surface reactions of interests. This study demonstrates the potential and limitation for a highly sensitive, label-free, and real-time SPR imaging sensor based on periodic metallic nanowires.

P1-62 | p210-p213 | 5월 9일 | 2층 로비

마이크로 전달 어드미턴스 스캐너의 개발에 대한 기초연구

구환, 권지현, 우응제
경희대학교 동서의료공학과

Design of a microscopic trans-admittance scanner (TAS)

H. Koo, J.H. Kuen and E. J. Woo
Department of Biomedical Engineering, Kyung Hee University, Korea

Abstract

Microscopic trans-admittance scanner (micro-TAS) is a new technique to visualize a distribution of exit currents flowing through a small biological object. The micro-TAS is composed of mainly four parts. First part includes a constant voltage source and several ammeters. Second part is a probe with 320 current-sensing electrodes. It is immersed in a saline and measures exit currents flowing through each grounded electrode. Third is a motor stage. It generates a linear motion of the probe to scan a larger field-of-view inside a sample chamber. The motor stage has three perpendicular axes of x, y and z and is controlled by a main controller. The last part is a sample chamber that includes a biological tissue and saline as the background. It also includes a large reference electrode on its bottom where we apply a constant voltage. We constructed a prototype micro-TAS and tested it using TX-151 objects and insulators. Future work is suggested to improve the image of exit currents.

P1-63 | p214-p217 | 5월 9일 | 2층 로비

생체 삽입형 기기를 위한 유연 인쇄 기판 기반 폐쇄 자기회로 구조의 무선 전력 전송 모듈

정기현, 김용호, 김용준
연세대학교 기계공학과

High Efficiency Wireless Power Transmission for Implantable Devices Using FPCB Based Inductive Component of Closed-magnetic Circuit

K. H. Jung, Y. H. Kim, and Y. J. Kim
School of Mechanical Engineering, Yonsei University

Abstract

Recently, implantable devices are widely researched and developed. Most existing implantable devices inevitably need an electrical power. Therefore, the inductor pairs are proposed in this study for wireless power transmission. The integrated flexible inductor was designed for wireless power transmission to implanted devices.

The primary inductor is attached on the patient's skin and the secondary inductor is implanted under the subcutaneous tissue. The transmission efficiency is decided by the induced magnetic flux to the secondary inductor. In this study, a permalloy which is alloyed nickel 81 % and iron 19 % is used because of high permeability and easy fabrication process. And the in-vitro experiment has been performed for confirming the transmission efficiency.

P1-64 | p218-p221 | 5월 9일 | 2층 로비

유연인쇄회로기판과 MEMS 기술을 이용한 초소형 심전도 센서

김홍래, 김용호, 김용준
연세대학교 기계공학과

Miniature Electrocardiography Sensor Using Flexible Printed Circuit and MEMS Technology

H. L. Kim, Y. H. Kim, Y. J. Kim
Department of Mechanical Engineering, Yonsei University

Abstract

In this paper, we present the miniature electrocardiography sensors using both flexible printed circuit (FPCB) and MEMS technologies. The sensors are composed of bipolar Laplacian electrode and polyimide substrate. The proposed ECG sensor has excellent flexibility and it is very thin because it is made using polyimide substrate. Two ECG sensors provide electrocadiographies to monitor the cardiac condition.

P1-65 | p222-p225 | 5월 9일 | 2층 로비

낙상으로 인한 골절방지를 위한 시뮬레이션을 이용한 충돌면의 계수 연구

김성현[1], 김용욱[2], 김남균[3], 김동욱[3]
[1]전북대학교 대학원 의용생체공학과, [2]전북대학교 헬스케어 기술개발 사업단, [3]전북대학교 공과대학 바이오메티컬공학부

Parameter Study on the Contact Surface to Prevent Fracture from Falls Using Computer Simulations

S. H. Kim[1], Y. Y. Kim[2], N. G. Kim[3], D. W. Kim[3]
[1]Dept. of Biomedical Engineering, Graduate School, Chonbuk National Univ,
[2]Center for Healthcare Technology Development, Chonbuk National Univ,
[3]Division of Biomedical Engineering, College of Engineering, Chonbuk National Univ

Abstract

Social activities of the elderly have been increasing as our society progresses toward an aging society. As their activities increases, so does the occurrence of falls that could lead to fractures. Fractures are serious health hazards to the elderly, which might result in eventual fatality. Therefore, development of a system to prevent fractures from falls that might occur during normal activities is essential in an aging society.

As an effort to develop a device to prevent fracture from falls, a parameter study on the mechanical properties of a contact surface to avoid fracture and minimize impact from falls has been performed using computer simulations based on actual motion data of falls. The actual motion data of falls were captured using a moving mattress that can safely induce unexpected falls with motion capture device. Healthy younger subjects participated in the actual fall experiments. The falls of the elderly were simulated using a realistic human model of aged persons. Parameter design study and a gradient based optimization was performed to find elastic properties of the contact surface that can minimize the Impact Force to prevent fracture within allowable displacement of contact surface. The obtained elastic properties of the contact surface will be a guideline to design an air bag that can prevent fracture.

P1-66 | p226-p228 | 5월 9일 | 2층 로비

광선 열자극 시 흰쥐의 회피반응 검출기

노정훈, 김명철, 예수영, 전계록
부산대학교 의학전문대학원 의공학과

Paw Withdrawal Reflex Detector from Thermal Stimulation by Radiant Heat

J. H. Ro, M. C. Kim, S. Y. Ye, and G. R. Jeon
Department of Biomedical Engineering, School of Medicine, Pusan National University

Abstract

In this paper, we present the sensory part of the thermal stimulus analysis system, which plays an important role in diagnosing central nervous system. The sensor receives the reflected light from the animal paw and detects an abrupt decrease of the reflected light intensity. The thermal stimulation is made by a focused halogen lamp light, and the ripple of the light intensity introduced by the AC electric power is the largest noise source. We introduced 120Hz notch filter to eliminate the noise, and have very good time resolution of less than 2.0 ms. This design is simpler and more sensitive than conventional edge light detection system.

P1-67 | p229-p231 | 5월 9일 | 2층 로비

다 밴드 디지털 보청기 및 적합 모듈 개발

양동권[1], 방동혁[1], 전유용[1], 길세기[1,2], 이상민[1,2]
[1]인하대학교 전자공학과, [2]인하대학교 정보전자 공동연구소

Development of the Multi-band Digital Hearing Aids and Fitting Module

D.G. Yang[1], D.H. Bang[1], Y.Y. Jeon[1], S.K.Kil[1,2] and S.M. Lee[1,2]
[1]Department of Electronic Engineering, Inha University,
[2]Institute for Information and Electronics Research, Inha University

Abstract

In this paper, we developed a hearing aid available for multi-band amplification. The developed hearing aid algorithm mainly consist of multi-band amplification, feedback cancellation, and output compression limiter. Also, we developed the optimal parameter fitting program of digital hearing aid according to individual hearing loss of hearing impaired person.

P1-68 | p232-p235 | 5월 9일 | 2층 로비

무릎 신전 모멘트 추정을 위한 사두근 건의 슬랙길이 추정

이우은, 남윤수, 엄현우
강원대학교 공과대학 기계메카트로닉스학부

Estimation of Quadriceps Tendon Slack Length for Knee Extensor Moment Approximations

W. E. Lee, Y. S. Nam, H. W. Uhm
Division of Mechanical Engineering & Mechatronics, Kangwon National University.

Abstract

In this paper, we propose a model to predict the knee extensor moment using the angle of the joints and EMG signal. We need a exact muscle parameters, But It is very difficult. The muscle force is sensitive to the tendon slack length. So. We propose the algorithm which finds the tendon slack length of quadriceps for more accuracy estimation of knee extensor moment. Algorithm realization is used the MATLAB optimization tool box. And it is evaluated use a experiment data.

P1-69 | p236-p239 | 5월 9일 | 2층 로비

보행훈련기기의 기준규격 개발

황성재[1], 김정윤[1], 손종상[1], 문곤성[3], 강영규[2], 정희교[2], 김영호[1,3]
[1]연세대학교 의공학과, [2]식품의약품안전청, [3]연세대학교 의료공학연구원

The Development of Standards of the Gait Training System

S. J. Hwang[1], J. Y. Kim[1], J. S. Son[1], G. S. Moon[1], Y. K. Kang[2], H. K. Jeong[2] and Y. H. Kim[1,3]
[1]Department of Biomedical Engineering, Yonsei University, [2]Korea Food & Drug Administration,
[3]Institute of Medical Engineering, Yonsei University

Abstract

The purpose of this study is to provide general safety requirements and efficiency of gait training systems. It also includes the standards of test methods, terminology and classification, and clinical assessment guidelines of the gait training systems. In this study, we completed the investigation of domestic and foreign situations about gait training systems, searching various domestic and foreign literature and data. We selected items to evaluate the safety and efficiency of gait training systems, analyzing domestic and foreign relative standards and obtaining technical consulting of experts and relating companies. In addition, we developed standards of test procedures for gait training systems through the analysis of the experiment results and provided the manual of the standard test of gait training systems. And we provided the clinical assessment guidelines of gait training systems by the analysis of preceeding studies and technical consulting of clinical experts.

P1-70 | p240-p242 | 5월 9일 | 2층 로비

시-청각 단서 제공 읽기 훈련 프로그램

방동혁[1], 길세기[1,2], 권미선[3], 이상민[1,2]
[1]인하대학교 전자공학과, [2]인하대학교 정보전자 공동연구소, [3]서울아산병원 신경과

Reading Training Software offering Visual-Auditory Cue

D. H. Bang[1], S. K. Kil[1,2], M. S. Kwon[3], S. M. Lee[1,2]
[1]Department of Electronic Engineering, Inha University,
[2]Institute for Information and Electronics Research, Inha University, [3]Dept. of Neurology, Asan Medical Center

Abstract

In this paper, we developed a reading training program which is able to offer visual-auditory cue for motor speech disorder. The program has the functions of finding the starting point of each recorded speech and eliminating the auditory-cue sound which can be noise on consonant speech sound. The sentences used in this program were made by a professional in speech therapy field. It is verified that the developed program operate effectively by real experiment for 6 reagents.

P1-71 | p243-p245 | 5월 9일 | 2층 로비

신경전달물질 및 물리적 자극에 대한 뼈 세포의 반응

곽지현, 김병관, 이헌구, 김선영, 김지현
연세대학교 보건과학대학 의공학부

Bone Cell Response to Neurotransmitters and Mechanical Loading

J. H. Kwag, B. G. Kim, H. G. Lee, S. Y. Kim, C. H. Kim
Department of Biomedical Engineering, Yonsei University

Abstract

Mechanical loading results in an increase in bone formation and decrease in bone resorption. Neurotransmitters are present inside the bone tissue and may have the potential to regulate bone remodeling. In this study, our objective was to determine the effect of oscillatory fluid flow-induced shear stress on bone resorptive activities in the presence of vasoactive intestinal peptide (VIP). RANKL and OPG gene expression results indicate that bone resorption may be further suppressed through combined effects of mechanical loading and neurotransmitters.

P1-72 | p246-p249 | 5월 9일 | 2층 로비

신경회로망을 이용한 sit-to-stand 동작에서의 무릎 관절 모멘트 추정

이재강, 남윤수, 엄현우
강원대학교 공과대학 기계메카트로닉스공학부

Knee joint moment estimation using neural network in sit-to-stand movement

J. K. Lee, Y. S. Nam, and H. W. Uhm
Division of Mechanical Engineering & Mechatronics, KangWon National University.

Abstract

Many studies have investigated to find the relationship between electromyography(EMG) and joint moment. In several studies, feed-forward neural network was used to estimate joint moment in elbow and knee. But those studies were performed in isokinetic movement with general back-propagation neural network. In this study we used NNARX(Neural network Auto regressive, eXternal input) model to identify relationship between EMG and knee joint moment in sit-to-stand movement which is representative movement in common human living. Validation of our proposed model was performed with simultaneously measured EMG and kinematic data during sit-to-stand.

P1-73 | p250-p254 | 5월 9일 | 2층 로비

신발 굽 높이와 굽 적응여부에 따른 정적·동적 균형능력 비교

이현주[1], 태기식[2]
[1]안동과학대학 물리치료과, [2]건양대학교 의공학과

Comparison of Static and Dynamic Balance Ability on the Heel Height and Adaptation

H. J. Lee[1], K. S. Tae[2]
[1]Dept. of Physical Therapy, Andong Science College, [2]Dept. of Biomedical Engineering, Konyang University

Abstract

This study examined the static and dynamic balance ability on the heel height (0 ㎝, 3 ㎝, 6 ㎝) and heel adaptation (group A is used to high heel shoes and group B is used to low heel shoes). 14 subjects aged 18 to 23 years participated in this study. Following a consent form, the static balance with opened eyes and closed eyes and dynamic balance (spatiotemporal parameters) were measured. The results revealed that the static balance ability was significant difference among the heel height, and was more difficult to balance control with closed eyes than opened eyes condition. Group A was seems to be higher balance ability than group B, but it was not difference significantly. Dynamic parameters with gait speed, stride length, stride width, toe out angle, and cadence were significant difference on heel height, however, these parameters did not found the significant difference between group A and B.

P1-74 | p255-p258 | 5월 9일 | 2층 로비

난소절제술과 칼슘섭취 수준이 성장기 흰쥐의 요추에 미치는 영향

김치훈, 박지형, 우대곤, 임도형, 김한성
연세대학교 의공학부

Effects of dietary calcium deficiency and ovariectomy on rat lumbars

C. H. Kim, J. H. Park, D. G. Woo, D. Lim and H. S. Kim
Department of Biomedical Engineering, Yonsei University

Abstract

In the present study, morphological and mechanical characteristics of vertebral bones of living rats with calcium free diet (CFD) and ovariectomy (OVX) were detected and tracked by using high resolution in-vivo micro-computed tomography (in-vivo micro-CT) and finite element (FE) analysis, to investigate the effect of CFD and OVX on generation of osteopenia. 9 female Sprague-Dawley rats (6 weeks old) were randomly divided into three groups (CFD group: 3, OVX group: 3 and normal group: 3). The CFD group were maintained on a refined calcium-controlled semisynthetic diet without added calcium. The OVX group was ovariectomized and then dosed orally with purified diet without added calcium, to accelerate osteoporosis in the rat. The lumbars (L1-L6) for each rat were scanned by micro-CT with 35μm resolution at 0 and 4th week for tracking the effects of CFD and OVX on generation of osteopenia. Structural parameters and effective modulus were computed by CT analyzer and FE analysis, respectively. Our findings indicated that osteopenic models induced by OVX and CFD were proper in detecting and tracking the effect of morphological and mechanical characteristics to understand osteopenia and could be used to investigate the metastasis of osteoporosis in lumbars (L1-L6).

P1-75 | p259-p262 | 5월 9일 | 2층 로비

편마비환자의 행동특성 평가 및 자기수용감각 훈련을 위한 가상현실 시스템 개발: 예비 실험

조상우[1], 구정훈[1], 이형래[1], 이원호[1], 한기완[1], 박진식[1], 김홍준[2], 강윤주[2], 김영수[3], 김인영[1], 김선일[1]
[1]한양대학교 의용생체공학과, [2]을지병원 재활의학과, [3]한양대학교 의과대학 신경외과학교실

Development of Virtual Reality System For Proprioception Training and behavioral characteristic Assessment of hemiplegia: A Pilot Study

S. W. Cho[1], J. H. Ku[1], H. R. Lee[1], W. H. Lee[1], K. W. Han[1], J. S. Park[1], H. J. Kim[2], Y. J. Kang[2], Y. S. Kim[3], I. Y. Kim[1] and S. I. Kim[1]
[1]Department of Biomedical Engineering, Hanyang University,
[2]Department of Rehabilitation medicine, Eulji University School of Medicine, Eulji General Hospital,
[3]Department of Neurosurgery, College of Medicine, Hanyang University

Abstract

In this study, we developed proprioception training system using virtual reality and pilot study is performed. Virtual reality task were composed two modes. In mode1, real-time movement of the body was provided using visual feedback. In mode2, body position was provided using visual feedback when participant have specific response. Five hemiplegic patients were participated. The hemiplegic patient performed the Mode 1 task and the Mode 2 task by each hand. In this result, the Mode 1 task provide better visual information than proprioceptive information. the Mode 2 task provide better proprioceptive information than Mode1 task. Left hemiplegic patient which right brain performing spatial sense was damaged have behavioral characteristic that low performance ability of mode2 than right hemiplegic patient. The next study will be verification of the system for training and assessment by clinical experiment.

P1-76 | p263-p266 | 5월 9일 | 2층 로비

하지 보조기 피드백 제어에 따른 일어서기 운동의 동력 보조 특성

김 경[1], 홍경주[1], 권대규[2,3], 김동욱[2], 김남균[2]
[1]전북대학교 대학원 의용생체공학과, [2]전북대학교 공과대학 바이오메디컬공학부, [3]전북대학교 고령친화복지기기연구센터

Characteristics of Power Assist of Sit-to-Stand Motion on the Feedback Control of Lower Limb Orthosis

Kyung Kim[1], Kyung-Ju Hong[1], Tae-Kyu Kwon[2,3], Dong-Wook Kim[2], Nam-Gyun Kim[2]
[1]Dept. of Biomedical Engineering, Graduate School, Chonbuk National Univ,
[2]Division of Biomedical Engineering, Chonbuk National Univ,
[3]Research Center of Healthcare & Welfare Instrument of the Aged, Chonbuk National Univ

Abstract

Lower limb orthosis with a pneumatic rubber actuator, which is intended for the assistance and the enhancement of lower limb muscular activities was developed. Compared to other sit-to-stnad(STS) assistive devices being developed by other researchers, our device is designed especially for aged people and intended only for slight assistance so that the subjects can keep their muscular strength. In this study, appropriate amount of power pattern of the device and the effectiveness of the system was investigated. For the analysis of muscular activities, Electromyography of the subjects was measured during STS motion. The muscles of interest were rectus femoris, vastus lateralis, vastus medialis and vastus intermedius muscles in the lower limbs. A Biodex dynamometer was used to measure the maximal concentric strength of the knee extensors of wearing and not wearing the orthosis on right side. The test were performed using the concentric isokinetic mode of tesing with the velocity set at 60°/s for the knee muscle. The experiment results in STS motion showed that the muscular activities wearing the lower limb orthosis were reduced and the peak torque values wearing it were increased. With this, we confirmed the effectiveness of the developed lower limb orthosis.

P1-77 | p267-p270 | 5월 9일 | 2층 로비

Analysis on the Training Effects of Posture Control for the Elderly Adults

Yong-Jun Piao[1], Mi Yu[1], Tae-Kyu Kwon[2], Dong-Wook Kim[2], and Nam-Gyun Kim[2]
[1]Department of Biomedical Engineering, Graduate school, Chonbuk National University
[2]Division of Biomedical Engineering, College of Engineering, Chonbuk National University

Abstract

This study presented the training effects of a training system based on an unstable platform and a visual interactive system for improving the sense of equilibrium and the ability of postural control. The training system consisted of an unstable platform, a safety harness, a monitoring device, and a personal-computer. To confirm the effects of the training system, thirty elderly volunteers took part in the experiments. Fifteen elderly volunteers went through a series of balance training using this system. Fifteen elderly volunteers as the control group compared with the training group. To evaluate the effects of the training, we measured relevant parameters such as the time of timed up and go test, the transfer limits of the different directions, root mean square of center of pressure in antero-posterior direction and medio-lateral direction before and that after the training. The results showed that the training system could successfully assess the gradual improvement of the postural control capability of the volunteers and showed a possibility of improving balance capability of the volunteers. Moreover, the significant improvement in the postural capability of the elderly subjects suggested that elderly subjects could benefit more from the training using the system for the improvement of the ability of postural control

P1-78 | p271-p273 | 5월 9일 | 2층 로비

유한요소 분석을 이용한 한국형 인공 슬관절 대퇴 치환물의 설계

조명래[1], 서정희[1], 김정성[2], 김병수[2], 이성재[1]
[1]인제대학교 의용공학과, [2]코렌텍 중앙기술연구소

Design of Femoral Components for the Artificial Knee Joint for Koreans based on Finite Element Analysis

M. L. Jo[1], J. H. Seo[1], J. S. Kim[2], B. S. Kim[2], S. J. Lee[1]
[1]Department of Biomedical Engineering, Inje University, Gimhae, Korea, [2]R & D center, Corentec, Inc.,

Abstract

Total Knee Arthroplasty(TKA) is one of the most successful and effective treatment for degenerative disease of the knee joint. Proper use of dimension and shape is very important for post-operative stability of the implant. Currently, TKR components with smaller dimension and shape are being developed to meet the needs of Koreans and Asians in general. In this study, we evaluated stress distribution within the femoral component during the design process to minimize component failure and adverse stress concentration. Based on the previous morphorlogical analysis on the femoral condyle dimension of average Korean, three kinds of femoral component(53mm, 65mm, 68mm) were selected and their finite element (FE) models were constructed. Anteriorly-directed load of 11200N was applied with appropriate constraints based on the standard test protocol in literature. Stress distribution within the components was assessed. The process continued until stress values were comparable to those of leading TKR product. Modification process include adding structures to distribute stress or rounding of the corners to reduce stress concentration. Our results showed that structure addition lowered peak von Mises stress by 5.8% in the 53mm-size but adversely increased by 13.6% and 11.8% in others (65mm-and 68mm-sizes). 29.4% and 11.1% reduction in stress were found with rounding of the corners in the 53mm- & 68-mm sizes and 6.2% increase was noted in the 65mm-size. These results suggest that making round shape is more effective than adding structure in reducing adverse stresses within the femoral component.

P1-79 | p274-p277 | 5월 9일 | 2층 로비

ProDisc-L 다분절 시술에 따른 척추 분절의 운동성 및 후관절 하중 변화

전성철[1], Wen-Ming Chen[2], 박춘근[3], 이권용[4], 이성재[1]
[1]인제대학교 의용공학과, [2]싱가포르 국립대학 생체공학과, [3]가톨릭대학교 강남성모병원 신경외과, [4]세종대학교 기계공학과

Effects of Two-Level ProDisc-L Replacement on Lumbar Spine Kinematics and Facet Load

S. C. Jun[1], W. M. Chen[2], C. K. Park[3], K. Y. Lee[4] and S. J. Lee[1]
[1]Department of Biomedical Engineering, Inje University, [2]Division of Bioengineering, National University of Singapore,
[3]Department of Neurosurgery, Kangnam St. Mary's Hospital, the Catholic University,
[4]Department of Mechanical Engineering, Sejong University

Abstract

The goal of total disc replacement (TDR) is to replace the symptomatic degenerated disc and restore the function of the spinal segment. There have been lack of biomechanical information of the TDR to explain multi-level disc placements. In this study, we conducted a finite element (FE) study on the two-level TDR with ProDisc®-L (Synthes-Spine Solutions, Inc., Paoli, PA, USA) to study the kinematics and facet loads in the lumbar spine.

A 3-D nonlinear FE model of the intact lumbar motion segment (L3-S1) was created from computer tomography (CT) images of the cadaveric specimen (male, age 55, no pathologies). The implanted model was then modified from the intact model to simulate post-operative changes with two-level implantation of ProDisc®-L. All of the models were subject to 400N compressive pre-load and 10Nm pure moment. The FE model was used to predict the facet loads under flexion and extension motion and to study the inter-segmental motion of the lumbar spine in all of the motion mode.

For the FE analysis, a constructed FE model was in very close agreement with the experiment data. From our FE results, the facet loads at the implanted model remained relatively unchanged (5-6.6%) under flexion. On the other hand, during extension, the load supported by the facets increased to 82.1% at the superior level and 22.1% at the inferior level. In kinematics analysis, we found that the implanted level (L3-4 & L4-5) allow more inter-segmental rotation than the intact FE model. The range of motion of the superior and inferior implanted levels increased by 29-96%, 12-40%, respectively.

Our results demonstrated that the motion segment became more mobile and imposed more stresses on the facets at the implanted level. It remains to be seen whether this change of the facet load may lead to further facet degeneration.

P1-80 | p278-p281 | 5월 9일 | 2층 로비

유한요소법을 이용한 치과용 임플란트 고정체 형태에 따른 응력 분석

문종필[1], 이성재[1], 박기훈[2]
[1]인제대학교 의용공학과, [2]신우산기

Analysis of Stress According to the Fixture Shape of Dental Implant : A Finite Element Method Study

J. P. Moon[1], S. J. Lee[1], G. H. Park[2]
[1]Department of Biomedical Engineering, Inje University, [2]Sinwoo-industry

Abstract

Periodental tissue plays an important role in teeth. It properly distributes the loads to the maxillary bone that are applied during mastication. However, the absence of shock-absorbing tissues in the dental implant may cause unwanted stress concentration on the maxillary bone, which in turn triggers translation of fixture, screw loosening and the obstruction of the blood supply in the bone. The problems associated with stress concentration can be improved with design changes in the dental implant. The purpose of this study was to investigate the stress distribution according to the fixture shape using 3-D finite element (FE) method.

3-D FE model were constructed for three fixture types (straight, tapered, double-tapered). They were of same length, but different cylindrical shape for the threaded region. A vertical force of 150N was applied and resulting von Mises stress were assessed along the surrounding cancellous bone.

Our results showed that the double-tapered type fixture showed highest Von Mises Stress along the maxillary bone, followed by the tapered and the straight types. This may be due to the fact that the interface area with the surrounding maxillary bone in the double-tapered was the smallest. However, the the stress levels were too small to cause meaningful loosening of the implant. Rather, the stress distribution was most uniform in the double-tapered case. This demonstrated that the design changes can induce more favorable stress distribution while keeping the stress well below the detrimental level in the maxillary bone.

P1-81 | p282-p285 | 5월 9일 | 2층 로비

다분절 퇴행성 요추 질환 치료를 위한 연성 척추 고정기기의 Hybrid 고정술에 따른 운동학적 분석 : 유한요소 해석연구

이재원[1], 박경우[2], 이성재[1]
[1]인제대학교 의용공학과, [2]광혜병원

Kinematic analysis of hybrid stabilization with semi-rigid fixation system for the treatment of multisegmental degenerative lumbar disease : A finite element analysis

J. W. Lee[1], K. W. Park[2], S. J. Lee[1]
[1]Department of Biomedical Engineering, Inje University, [2]Kwang-Hye Spine Hospital

Abstract

Semi-rigid fixation is intended to preserve or restore the intersegmental motion while reducing adverse effects on the adjacent segments. Recently, it is being often used as a non-fusion type tension band in hybrid stabilization in conjunction with the posterior lumbar interbody fusion (PLIF) for the treatment of multisegmental degenerative lumbar disease. However, its biomechanical efficacy has been studied very sparsely. In this study, we constructed a finite element (FE) model of the lumbar spine to predict the changes in kinematic behavior after surgery. Particularly, the range of motion (ROM) and instantaneous axis of rotation (IAR) following semi-rigid stabilization were compared to those from a rigid fixation system.

A previously-validated 3-dimensional FE model of the intact lumbar spine (L1-L5) was used as the baseline. For the implanted models, the baseline model was altered to simulate the hybrid stabilization with PLIF and three kinds of pedicle screw systems; two semi-rigid (Ni-Ti rods, E = 75GPa, Φ = 4.0 mm, with a 3- and 6- coiled turns, respectively) and one conventional rigid fixation system (Ti6Al4V, E = 114GPa, Φ = 6.0 mm, straight rod with no turns). Compressive pre-load of 400N and flexion/extension pure moments of 10 Nm were imparted.

During Flexion/Extension, the ROM of semi-rigid fixation models decreased by 10.4%/1.6% and 5.7%/1.9% at the superiorly- and inferiorly-adjacent levels, respectively. The differences between two semi-rigid systems were negligible. The pattern of IAR of the semi- rigid fixation systems remained closer to that of the intact spine as compared to the rigid fixation system at the surgical levels(L2-L3, L3-L4). Particularly, 6-coiled semi-rigid fixation model recreated IAR closest to the intact model. No distinguishable differences were found between the models at the adjacent levels.

Our study demonstrated the biomechanical efficacy of the semi-rigid system in terms of restoring the kinematic behavior of lumbar spine. It appears that more compliant system as seen with the 6-coiled tension band can be more effective semi-rigid device with less screw insertion and higher motion preservation capability.

P1-82 | p286-p287 | 5월 9일 | 2층 로비

말초동맥 스텐트용 Zwitterionic PEG를 사용한 표면개질된 Nitinol-Au의 제조

신홍섭[1,3], 류현욱[1], 박귀덕[1], 문명운[2], 이광렬[2], 김지흥[3], 한동근[1]
한국과학기술연구원 [1]바이오소재연구센터, [2]계산과학센터, [3]성균관대학교 화학공학과

Preparation of Surface Modified Nitinol-Au using Zwitterionic PEG for Peripheral Arterial Stents

H. S. Shin[1,2], H. W. Yoo[1], K. Park[1], M. W. Moon[2], K. R. Lee[2], J. H. Kim[3], D. K. Han[1]
[1]Biomaterials Research Center, [2]Computational Science Center, Korea Institute of Science and Technology,
[3]Department of Chemical Engineering, SungKyunKwan University

Abstract

Blood compatible biomaterials have been of importance for a variety of biomedical applications. In this study, we have prepared a Nitinol-Au whose surface was grafted with zwitterionic PEG, with the aim of development of arterial stent. Poly(ethylene glycol) (PEG) is blood compatible and sulfobetaine ($-N^+-SO3^-$), a well-known class of zwitterionic polymer, is biocompatible as well. The Nitinol-Au surface sputtered with Gold (Au) was chemisorbed by various thiol compounds, and then the synthesized zwitterionic PEG was grafted onto Nitinol-Au. We hypothesize that the modified Nitinol-Au surfaces can be more blood compatible than untreated one.

P1-83 | p288-p290 | 5월 9일 | 2층 로비

생리활성 PLA/β-TCP복합지지체를 이용한 조직공학적 골 재생

정영미[1], 박민성[2], 이진우[2], 김영하[3], 김상헌[1], 김수현[1]
[1]한국과학기술연구원 바이오소재연구센터, [2]연세대학교 정형외과학교실, [3]광주과학기술원 신소재공학과

Bone regeneration with a bioactive PLA/β-TCP composite

Y. Jung[1], M. S. Park[2], J. W. Lee[2], Y. H. Kim[3], S.-H. Kim[1], S. H. Kim[1]
[1]Biomaterials Research Center, Korea Institute of Science and Technology, [2]Department of Orthopaedic Surgery, Yonsei University, [3]Department of Materials Science and Engineering, Gwangju Institute of Science and Technology

Abstract

There are many studies about preparing polymer/ceramic composites because of their good formability. However, most processes using solvent have the problem of decreasing the effect of bioceramic as an osteogenic induction factor due to the hindrance of bioceramic by polymer. The purpose of this study is to fabricate polymer/β-TCP composites by novel sintering for rapid bone regeneration through enhancing the interaction of cells and bone induction factor. The scaffold was prepared with polylactic acid (PLA) as a main matrix, beta-tricalcium phosphate (β-TCP) as an inductive growth and differentiation factor and NaCl as a porogen for3-dimensional structure. The cell-composite constructs were implanted at the backs of nude mice subcutaneously and in the rabbit bilateral critical-sized ulna bone defect model. Cell- composite constructs were evaluated with SEM and histological study were performed to observe tissue development. Cells were grown better to form bone-like structures on scaffolds fabricated by novel sintering than cells on scaffolds fabricated by solvent casting. Also, the result of alkaline phosphatase activity assay showed that osteogenic differentiation was sustained and enhanced significantly in the scaffolds fabricated by novel pressing.

P1-84 | p291-p293 | 5월 9일 | 2층 로비

유도가열에 의한 약물방출형 Thermorod의 약물 방출특성 연구

추현욱[1], 최성민[1], 박재근[1], 황은미[1], 박혜진[1], 조현설[2], 박주환[3], 김영곤[1]
[1]인제대학교 의생명공학대학 의용공학과, [2]광양보건대학 의료공학과, [3]고려상사(주)

Drug release characteristics of the drug coated thermorod by induction heating

H. W. Choo[1], S. M. Choi[1], J. G. Park[1], E. M. Hwang[1], H. J. Park[1], H. S. Cho[2]. J. H. Park[3] and Y. K. Kim[1]
[1]Dept. of Biomedical Engineering, Inje Univ., [2]Gwangyang health college, [3]KOS limited

Abstract

A chemotherapy give rise to many side effects. To minimize the side effects, many researches are being conducted with respect to drug delivery system(DDS). To date, there has been little study about controlling the drug release profile by thermal effect. This work focused on in-vitro study, drug-release characteristics of Polyethylene co-vinyl acetate (PEVA) coated thermorod according to the temperature and the secondary coating conditions. Four kinds of specimens were prepared. One is primary coated specimen and the others are secondary coated specimens by different PEVA/PBMA ratios. The specimens were tested in two different heating conditions: i.e. 36.5℃ and induction heating condition. The drug release rate was higher at induction heating condition, and the drug release rate of the secondary coated specimens was decreased. Exceptionally, little difference was showed at two different temperature conditions for secondary coated specimens in 2.1%PEVA, 0.9%PBMA and 97%THF solution.

P1-85 | p294-p296 | 5월 9일 | 2층 로비

주기적인 유체를 가한 해면골 조직에 배양된 Pre-osteoblasts에 대한 연구

김병관, 곽지현, 이헌구, 김선영, 김지현
연세대학교 보건과학대학 의공학부

Pre-Osteoblasts Cultured on Trabecular Bone Scaffold under Periodical Oscillatory Fluid Flow

B. G. Kim, J. H. Gwag, H. G. Lee, S. Y. Kim, C. H. Kim
Department of Biomedical Engineering, College of Health Sciences Yonsei University

Abstract

In this study, we investigated the proliferation and differentiation of bone cells in a 3D environment. Cylindrical 3D porcine trabecular bone scaffolds were prepared and seeded with MC3T3-E1 pre-osteoblastic cells. Cells were cultured in scaffolds for up to 2 weeks with or without fluid flow. The scaffold were then fixed, plastic embedded, and cut using a microtome. Histological analysis was performed using Goldner's trichrome staining. Cells were shown homogeneous distribution and proliferation in both control and loaded groups after 1 week. However, cells differentiated diversely in according to inner trabecular structure of scaffolds. Cells made extra cellular matrix to fill up cavities only on the exterior surface of scaffolds in control groups after 2 weeks. Loaded groups, on the other hands, composed extra cellular matrix deeper in the interior cavities than control groups and exterior surface as well. Although we could not discover specific geometrical composition of cells and extra cellular matrix depending on oscillatory shear forces, we verified that periodical oscillatory fluid flow promoted cells to make extra cellular matrix in inner parts of scaffold without continuous bioreactor system.

P1-86 | p297-p299 | 5월 9일 | 2층 로비

Mechanical Loading이 임신 쥐의 Primary 뼈 세포에 미치는 영향

이헌구, 김병관, 곽지현, 김지현
연세대학교 의학공학과

Effects of Pregnancy in Primary Bone Cells Exposed to Mechanical Loading

H. G. Lee, B. K. Kim, J. H. Kwag, C. H. Kim
Department of Biomedical Engineering, College of HealthSciences Yonsei University

Abstract

There are a number of in vitro models that have been developed to investigate the response of bone cells to mechanical loading. However, the relationship between pregnancy and loading-induced bone remodeling has not been well studied. Therefore, the aim of this study was to investigate whether bone during pregnancy responded differently to mechanical loading compared to bone during non-pregnant conditions. Primary bone cells were isolated from 11 week old ICR mice (Institute of Cancer Research, USA). The mice were either non-pregnant, 10-day pregnant, or 18-day pregnant. The long bones were harvested and bone cells were allowed to migrate out of the bone pieces into a culture dish for approximately 4 weeks. 48 hours prior to mechanical loading, cells were seeded on glass slides and treated with vitamin D3 for expression of receptor activator of NF-kB ligand (RANKL). Oscillatory fluid flow-induced shear stress was applied to cells at 1 Pa for 1 hour. Real-time RT-PCR was performed for quantification of genes related to bone formation and resorption. Specifically, expression of core binding factor 1 (cbfa1), osteopontin (OPN), collagen I, osteoprotegerin (OPG), and RANKL were quantified.

학생논문경연

S-1 | p300-p302 | 5월 9일 | 대강당

한국인 체형에 적합한 인공슬관절의 굽힘 각도 변화에 따른 역학적 특성 비교 분석

서정희[1], 조명래[1], 김정성[2,3], 김병수[2], 선두훈[2,4], 이성재[1]
[1]인제대학교 의용공학과, [2]코렌텍 중앙기술연구소, [3]연세대학교 의과대학 BK21 사업단, [4]대전 선병원 관절센터

Comparative Analysis of the Flexion Angle Variation in Total Knee Replacement for Korean : A Finite Element Analysis

J. H. Seo[1], M. L. Jo[1], J. S. Kim[2,3], B. S. Kim[2], D. H. Sun[2,4], S. J. Lee[1]
[1]Dept. of Biomedical Engineering, Inje University, [2]R & D center, Corentec Co., Ltd.,
[3]BK21 Project for Medical Science, College of Medicine, Yonsei University, [4]Joint center, Sun General Hospital, Daejeon

Abstract

Total knee arthroplasty(TKA) has revolutionized the treatment of patients with rheumatoid arthritis of the knee joint. The goal of TKA is to relieve pain and improve function. Recently TKR products are being designed and developed for Korean patients whose anatomic requirements may be different from Caucasians. The purpose of this study is to analyze biomechanical characteristics such as contact areas and contact stresses to determine the optimal design parameters for the articulating components for TKR. For this study, a finite element model of the Korean-prototype TKR was constructed. Various loading cases with corresponding flexion angles were simulated by changing the articulating orientation between the femoral component(FC, Co-Cr-Mb alloy) and the tibial insert(TI, UHMWPE). Resuting contact areas and contact stresses were assessed and then compared with those from literature.

At the contact position of the prototype TKR, we found that less contact stress than the other literature of result, the other side, more wide contact area than the literature of result. These results suggest that the Korean-prototype TKR would be provide structure congruency and stability while could be able to prevent TKR loosening and more helpful to rehabilitation after surgery.

S-2 | p303-p307 | 5월 9일 | 대강당

실시간 피질 리듬 모니터링 시스템을 이용한 뇌-컴퓨터 접속(BCI)에서의 Motor Imagery 훈련 시스템 개발

황한정, 서기현, 최기정, 김은빈, 권기운, 임창환
연세대학교 보건과학대학 의공학과

Motor Imagery Training System for Brain-Computer Interface (BCI) Using Real-time Cortical Rhythmic Activity Monitoring System

H. J. Hwang, G. H. Seo, K. J. Choi, E. B. Kim, K. W. Kwon, C. H. Im
Department of Biomedical Engineering, Yonsei University, Wonju, Korea

Abstract

In the present study, we propose a novel approach to training motor imagery tasks in EEG-based brain computer interface (BCI), based on a recent technique named a real-time cortical rhythmic activity monitoring system. In this preliminary experimental study, participants, who did not know how to perform the motor imagery tasks, could successfully perform the motor imagery tasks after only a few training sessions. We recorded continuous EEG signals while the subjects were imagining left or right hands movement, before and after the training session. The subjects' intentions were then detected using a conventional time-frequency analysis technique. The analysis results showed significant differences at mu rhythm between signals obtained before and after the training sessions. The preliminary results demonstrated that our system is effective in training motor imagery tasks for BCI application.

S-3 | p308-p311 | 5월 9일 | 대강당

컴프턴 영상 시스템을 위한 경계보전 최대사후 영상재구성

이미노, Van-Giang Nguyen, 이수진
배재대학교 전자공학과

Edge-Preserving Maximum *A Posteriori* Image Reconstruction for Compton Imaging Systems

M. N. Lee, V. G. Nguyen, S. J. Lee
Department of Electronic Engineering, Paichai University

Abstract

Compton imaging is a potentially more valuable 3-D technique in nuclear medicine than conventional emission tomography. Due to inherent computational limitations, however, it has been of a difficult problem to reconstruct images with good accuracy. In this paper, we investigate a maximum *a posteriori* (MAP) approach to Compton camera reconstruction, which provides reconstructions with superior noise characteristics compared to analytic methods. In order to accurately model spatial discontinuities that can occur occasionally in the object, we use a convex-nonquadratic smoothing prior and apply to a row-action based regularized maximum likelihood method, which provably converges to the true MAP solution. Our preliminary results demonstrate that the proposed method significantly improves quality of reconstructed images as well as convergence speed.

S-4 | p312-p313 | 5월 9일 | 대강당

전기자극에 의한 Neuronal cell migration에 대한 연구

정세훈[1,3], 전상범[2,3], 송종근[2,3], 김성준[1,2,3]
[1]서울대학교 뇌과학협동과정, [2]서울대학교 전기컴퓨터공학부, [3]초미세 생체전자 시스템 연구센터

A study of neuronal cell migration induced by electrical stimulation on microelectrode arrays

S. H. Jeong[1,3], S. B. Jun[2,3], J. K. Song[2,3], S. J. Kim[1,2,3]
[1]Interdisciplinary Program in Brain Science, Seoul National University,
[2]School of Electrical Engineering, Seoul National University, [3]Nano-Bioelectronics & Systems Research Center

Abstract

A variety of methods have been employed to control neuronal migration in neural networks. Recently, we found that electrical stimulation can induce neuronal cell migration in neural networks cultured for more than three weeks on microelectrode arrays (MEAs). Immunocytochemistry data showed that the aggregation of neurons was related to the emergence of glia in culture. In this study, when co-cultured with glia, we could induce neuronal migration at one week in culture by electrical stimulation while the same condition of stimulation caused neural necrosis in neuron-only cultures. In addition, the stimulation-induced migration was inhibited by blocking action potential in neural networks using voltage-gated sodium channel blocker, tetrodotoxin (TTX). These results indicate that neuronal cell migration is dependent on neuronal activity evoked by electrical stimulation. Thus, electrical stimulation may provide a useful means for modifying neural networks and improving the interface between electrodes and neurons.

S-5 | p314-p317 | 5월 9일 | 대강당

PDMS와 Silver Ball 기반의 생체적합성 멀티채널 표면전극 제작과 Nerve Conduction Study에 적용

이은중[1], 백동현[1,3], 백주열[1], 김병조[2], 박정호[3], 이상훈[1]
[1]고려대학교 보건과학대학 생체의공학과, [2]고려대학교 병원 신경과, [3]고려대학교 전기 전자공학과

Biocompatible Multi-channel Surface Electrode based on PDMS and Silver Ball, and its Application to Nerve Conduction Study

E. J. Lee[1], D. H. Baek[1,3], J. Y. Baek[1], B.J Kim[2], J. H. Pak[3], S. H. Lee[1]
[1]Department of Biomedical Engineering, College of Health Science, Korea University
[2]Dept. of Neurology, Korea University Medical Center
[3]Dept. of Electrical Engineering, Korea University

Abstract

We have developed the multichannel surface electrode for the nerve conduction study in patients with neuromuscular disorder. As electrode material, we used PDMS which is flexible, biocompatible, non-toxic and non-flammable as substrate and silver ball as contacting electrode. Conducting gel was easily coatable on the electrode surface without causing interference of neighboring electrode. In this case, the impedance enhance much better and almost comparable with commercial large electrode. The signals measured from abductor pollicis brevis were noiseless and the clinical feasibility was evaluated by the quantitative investigation of the latencies of compound muscle action potentials in normal subject and patients with diabetes mellitus.

S-6 | p318-p321 | 5월 9일 | 대강당

인지능력 평가를 위한 소프트웨어 구현

류완석[1,2], 김동한[1], 허준행[1], 김휴정[2], 강한수[2], 정성택[1]
[1]한국산업기술대학교 컴퓨터공학과, [2]포텍마이크로시스템

Implementation of Software for Cognitive Competence Assessment

W.S. Ryu[1,2], D.H. Kim[1], J.H. Heo[1], H.J. Kim[2], H.S. Kang[2], S.T. Chung[1]
[1]Dept. of Computer Engineering, Korea Polytechnic University, [2]Foretek Microsystem

Abstract

Increasingly in recent years, researchers have explored the influence of a variety of health and biological contexts on late-life cognitive competence. In this study, a software for assessment of cognitive competence such as concentration, memory, reaction time is proposed. It developed a user interface by the MFC programming language for design optimization of a touch screen monitor.

구연논문 Ⅰ

특강주제

좌장 | 정병조(연세대), 윤종인(대구가톨릭대)

O1-1 | p322 | 5월 9일 | 1층 회의실

포토닉스 기반의 나노 바이오 융합 기술

조용훈
충북대학교 물리학과, 나노-바이오-포토닉스 연구실

Abstract

세계적으로 각 연구 분야 사이의 융합 연구의 중요성이 강조되고 있는 가운데, 나노 바이오 융합 연구를 통한 신기능 센서, 분석 기술, 의용생체 기반 연구에 큰 관심과 투자가 이루어지고 있다. 최근 양자점, 나노입자, 나노막대, 광결정 등과 같은 다양한 나노 포토닉스 구조체를 기반으로 한 고성능의 포토닉스 소자 개발과 함께 신개념의 나노 바이오 활용 기술에 대한 연구가 활발하다. 포토닉스 기반의 나노 바이오 융합 기술은 나노 영역에서 물질과 빛의 상호작용을 다루는 '나노 포토닉스' 분야와 바이오 개체 사이의 상호작용을 빛으로서 감지하는 '바이오 포토닉스' 분야가 상호 보완적으로 접목된 연구 분야로서, 기존의 한계를 극복한 신개념의 나노 바이오 융합 기술 개발에 널리 활용될 것으로 기대된다. 본 발표에서는 나노 포토닉스 구조체를 활용한 기능성 광이미징, 하이브이드형 광소자, 바이오 센서/칩 기술 등을 중심으로 최근 연구 동향과 결과들을 소개하고자 한다.

O1-2 | p323 | 5월 9일 | 1층 회의실

Introduction to Frequency-Domain Optical Coherence Tomography as a Biomedical Imaging Modality

최은서
조선대학교 물리학과

Abstract

질병부위에 대한 생의학적인 정보를 획득하는데 생체의 절개없이 환부를 진단하고자 이미지를 기반으로 하는 진단법(image-guided diagnostic)이 활달하게 이용되고 있다. 이러한 대표적인 방법으로 X-ray 또는 자기장을 이용한 생체단면영상 기술이 주로 이용되고 있으며 이외에 방사선 물질을 이용한 PET(Positron emission tomography) 또는 SPECT(Single photon emission computed tomography) 같은 방법을 이용함으로써 실제로 암과 같은 질병을 진단하는데 유용한 정보를 제공하고 있다. 하지만 이러한 개개의 이미징 방법(imaging modality)들이 획득할 수 있는 정보에 있어서 한계성을 가지고 있는 이유로 인해서 이러한 단점을 극복하고자 다양한 방법을 통해서 얻은 여러 이미지들을 하나의 융합된 이미지로 가공함으로써 보다 다양한 생체정보를 제공하고자 하는 연구가지속적으로 진행되고 있다. 하지만 기존의 imaging modality들이 가지는 낮은 분해능은 조기진단을 위한 방법으로는 궁극적인 한계를 보이고 있으며 이러한 단점을 해결하기 위한 대안으로 광학적인 접근법이 크게 각광을 받고 있다. 그 중에서 비절개적으로 고분해능 생체 내부의 단면 이미징을 수행할 수 있는 OCT(Optical Coherence Tomography)를 소개하고자 한다. OCT는 고전적인 광간섭을 이용하되 백색광원의 낮은 결맞음성을 활용해 수 마이크론에 이르는 섬세한 해부학적인 이미징을 수행할 수 있을 뿐만 아니라 동시에 미세한 위상 변화를 광학적으로 측정함으로써 동적인 변화를 정밀하게 측정할 수 있는 장점을 가질 수 있다. 이를 통해서 기존 imaging modality들이 가지는 해부학적인 정보뿐만 아니라 기 functional imaging의 역할을 수행 할 수 있다. OCT는 보다 동적인 현상을 면밀히 이미징하고자 최근 들어 주파수 영역에서 간섭무늬를 획득하는 FD-OCT(frequency-domain OCT) 기법을 이용하고 있다. 본 발표에서는 이러한 FD-OCT 기법에 대한 기본적인 광학적 원리와 이에 근거한 시스템의 구성에서의 특징과 장점을 설명하고 이를 활용한 생의학 이미징 결과를 제시함으로써 차세대 생체영상진단기기로써의 높은 가능성을 소개하고자 한다.

O1-3 | p324 | 5월 9일 | 1층 회의실

Ultra-high-speed optical spectroscopy in time-wavelength technique with a stretched pulse supercontinuum source

김덕영
광주과학기술원, 정보통신공학과

Abstract

We introduce a new high-speed optical spectroscopic measurement scheme based on a time-wavelength technique by using a stretch-pulse supercontinuum light source. Ultra-high speed Fourier-domain optical coherence tomography (FD-OCT) is demonstrated based on this technique. A wide-band short pulse of a supercontinuum source of which output spectrum spanned a wavelength range from 1,200 nm to 1,550 nm was stretched to a long pulse of 70-ns duration by using a dispersive fiber due to the group-velocity dispersion, and it was used directly as frequency-swept light for FD-OCT. The OCT spectral interferogram was acquired in the time domain and converted into the spectral domain by the pre-calibrated time-to-wavelength relation. Using this stretched-pulse time-wavelength measurement technique, we have demonstrated an ultra-high-speed axial-line scanning rate of 5 MHz. The axial resolution of 8 mm was achieved without re-calibration of the sweep characteristic owing to the passive nature of the frequency-sweeping mechanism.

O1-4 | p325 | 5월 9일 | 1층 회의실

봉한 경락계의 imaging

소광섭
서울대 물리학과

Abstract

쥐의 피부에서 경락의 해부학적 실체를 관찰분석 하는 방법을 소개한다. 왜 지금까지 볼수 없었는가, 어떤 방법으로 찾을 수 있었는가를 설명한다. 시각화를 위한 염료의 개발, 주입기술의 개발, 관찰방법을 제시한다. 조직학적 분석의 결과 새로운 조직임을 어떻게 보였는가를 설명한다.

이에 바탕하여 앞으로 경락의 영상화를 위하여 어떤 연구가 계획되고 있는가를 논한다. 먼저 조영제의 개발에 필요한 요구조건을 고려한다. 다음에 이를 주입하는 기술의 개발에 대하여 고찰한다. 형광 관찰 시스템의 설계를 기초적 시험적 모형과 개선의 방향을 제시한다. 경락 샘플의 분석 방법에 대하여 설명한다.

두번째 주제로 피부에서 내부 장기로 순환의 연구에 대하여 현재의 진행상황을 설명한다. 앞으로 이의 영상화를 위한 MRI나 PET 등의 적용을 논한다.

끝으로 이 연구의 파급효과를 학제적 연구 측면과 진단 및 치료 기기 개발, 신약개발과 관련하여 논한다.

O1-5 | p326 | 5월 9일 | 1층 회의실

Applications of diffuse optics in humans and small animals

김법민
연세대학교 보건과학대학 의공학부

Abstract

Diffuse optics is a relatively new, non-invasive and non-ionizing method to measure optical properties (scattering, absorption coefficient) and physiological properties (water fraction, concentration of oxy-, deoxy-hemoglobin, cytochrome c oxidase, etc) of biological tissues. Its biological applications include functional brain imaging, brain machine interface, molecular imaging, etc. Recent advances of diffuse optics in humans and small animals are reviewed in this presentation.

구연논문 II

영상분야

좌장 | 이종민(한양대), 최흥호(인제대)

O2-1 | p327-p330 | 5월 9일 | 2층 강의실

Image Intensifier를 이용한 Micro-CT System의 개발

최정민, 김규원, 한병희, 조민형, 이수열
경희대학교 전자정보대학 동서의료공학과

Development of an Image Intensifier based Micro-CT System

J. M. Choi, G. W. Kim, B. H. Han, M. H. Cho, and S. Y. Lee
Department of Biomedical Engineering, Kyung Hee University, Republic of Korea

Abstract

We have developed an image intensifier based micro-CT system with a microfocus x-ray source and a image intensifier detector. The 2D array detector consists of 1344×1024 elements, and its pixel size is 50㎛×50㎛ with a cesium iodide(CsI) scintillator. The performances of the micro-CT system were evaluated with a contrast phantom and a gold wire phantom. The minimum resolvable contrast is about 14 CT number at tube voltage 26.7kVp and tube current 33㎂. The spatial resolution of the micro-CT system is more than 7lp/mm depending on the magnification ratio. Femur images of a SD rat is shown.

O2-2 | p331-p332 | 5월 9일 | 2층 강의실

두경부의 방사선치료를 위한 MVS 기반의 자기공명분광법에 대한 예비연구

윤성익[1], 김영주[2], 최보영[1]
[1]가톨릭대학교 의과대학 의공학교실, [2]가톨릭대학교 의과대학 영상의학교실

A study of MVS-based MRS for radiotherapy in brain

S. I. Yoon[1], Y. J. Kim[2], B. Y. Choe[1]
[1]Department of Biomedical Engineering, College of Medicine, The Catholic University of Korea,
[2]Department of Radiology, College of Medicine, The Catholic University of Korea

Abstract

방사선치료는 의학영상을 기반으로 가상적인 방사선 선량분포를 얻어내는 시뮬레이션 과정이 필수적이다. 이러한 모의 방사선 치료계획은 의학영상을 사용하므로 많은 영상정보들이 포함된다. 현재까지는 CT를 중심으로 하는 치료계획이 전형적인 과정으로 되어 있다. 그런데 IMRT 기술과 장비의 사용은 동일한 평면 내에서 Intensity의 조절이 가능하여서 PTV 내의 세포들의 분자적 상태를 고려해 줄 수 있는 방법이 보완되어야 한다. 이러한 이유에서 자기공명분광법의 대사영상은 대사물질의 변화를 임상적으로 뒷받침해 줄 것이다.

O2-3 | p333-p335 | 5월 9일 | 2층 강의실

프레임율이 향상된 3차 고조파 검출 기법

송재희, 김상민, 송태경
서강대학교 의공학 기술 연구 센터

A 3rd Harmonic Extraction Technique with An Increased Frame Rate

J. H. Song, S. M. Kim, T. K. Song
Center for Medical Solutions Research, Sogang University

Abstract

Ultrasound imaging using harmonic signals provide more diagnostic information than the conventional fundamental imaging. Especially super harmonics such as 3rd harmonic and 4th harmonic show higher CTR(contrast agent to tissue signal ratio) which makes them useful for ultrasound contrast agent imaging and ultrasonic molecular imaging using targeted contrast agents. Multi-pulse techniques like CPS(contrast pulse sequence) and TPS(triple pulse sequence) are most popular methods for separating 3rd harmonic signals from received signals. Those 2 methods, however, should transmit a pulse at least three times along each scanline with different phase and amplitude, resulting in the frame rate reduction. In this paper, we propose a technique using two pulses with 90° phase difference and a simple digital filter to increase the frame rate. It is proved mathematically and through computer simulations that the proposed method extracts the 3rd harmonic signal form received signal very efficiently.

O2-4 | p336-p338 | 5월 9일 | 2층 강의실

[^{18}F]FDG PET을 이용한 토끼 망막에서의 시각 및 전기 자극에 따른 당대사량 활성화 비교

김수진, 이재성, 우세준, 김의태, 서종모, 김성준, 이동수
서울대학교 협동과정 방사선응용생명과학, 서울대학교 의과대학 핵의학교실, 서울대학교 의과대학 안과학교실
서울대학교 공과대학 전기.컴퓨터공학부, 초미세생체전자시스템연구센터, 나노인공시각개발센터

A comparative FDG activation study on light and electrical stimulations of the rabbit retina using [^{18}F]FDG PET

S. J. Kim, J. S. Lee, S. J. Woo, E. T. Kim, J. M. Seo, S. J. Kim, D. S. Lee
Interdisciplinary Program in Radiation Applied Life Science, Seoul National University,
Department of Nuclear Medicine, Seoul National University College of Medicine,
Department of Ophthalmology, Seoul National University College of Medicine,
School of Electrical Engineering and Computer Science, Seoul National University,
Nano Bioelectronics & Systems Research Center, Nano Artificial Vision Research Center

Abstract

The aim of this study was to obtain perception responses in the visual cortex after electrical stimulation of the retina, and compared with responses by light stimulation using a small animal dedicated PET system. Five dynamic PET data from 3 rabbits were acquired over 60 min after injecting ^{18}F-fluoro-deoxy-glucose ([^{18}F]FDG, 37 MBq) in a different day. A resting PET was performed without stimuli. For light stimulation, repetitive flash light of the whole visual field (0.3 Hz) was applied to one eye 1 min prior to FDG injection for 6 min, and for electrical stimulation, repetitive electrical retinal stimulation (500μA, 1 Hz) was applied to the same eye using a suprachoroidal polyimide electrode array placed under the visual streak. Quantitative changes in cerebral glucose metabolism were calculated by 3D voxel-based statistical analysis. Known visual cortex and frontal eye field in rabbit brains were activated by both the light and electrical stimulations. Lateralization of the response was observed using the high resolution animal dedicated PET scanner. These results indicate that the electrical retinal stimulation could induce visual perception in the brain of rabbit.

O2-5 | p339-p341 | 5월 9일 | 2층 강의실

최대선량깊이에서의 광섬유 방사선량계의 선형성 평가 및 상대깊이선량율 측정

장경원[1], 조동현[1], 신상훈[1], 유욱재[1], 서정기[1], 이봉수[1], 조효성[2], 김신[3]
[1]건국대학교 의료생명대학 의학공학부, 의공학 실용기술 연구소, [2]연세대학교 보건과학대학 방사선학과
[3]제주대학교 에너지공학과, 방사선 기술 연구소

Evaluation of a Linearity and Measurements of Percent Depth Doses using a Fiber-optic Dosimeter in Maximum Dose Depth

K. W. Jang[1], D. H. Cho[1], S. H. Shin[1], W. J. Yoo[1], J. K. Seo[1], B. Lee[1], H. Cho[2], and S. Kim[3]
[1]School of Biomedical Engineering, Research Institute of Biomedical Engineering,
College of Biomedical & Health Science, Konkuk University,
[2]Department of Radiological Science, Yonsei University,
[3]Department of Nuclear & Energy Engineering, Applied Radiological Science Research Institute, Cheju University

Abstract

In this study, an organic scintillator -optical fiber dosimeter is fabricated to measure high-energy photon beam from a clinical linear accelerator (CLINAC). We have measured linear responses of a fiber-optic dosimeter according to dose rates and monitor units (MU) of a CLINAC. Also, a percent depth dose (PDD) curve for 6 MV photon beam and relative doses according to different field sizes are obtained.

포스터 II

P2-1 | p342-p345 | 5월 10일 | 2층 로비

기류 상승속도를 고려한 최대호식기류 보정기법

김경아, 이인광, 최성수, 김성식, 차은종
충북대학교 의과대학 의공학교실, 충북 BIT 연구중심대학사업단

Peak expiratory flow rate compensation technique by initial slope on the flow rate signal

K. A. Kim, I. K. Lee, S. S. Choi, S. S. Kim, and E. J. Cha.
Biomedical Engineering Department, School of Medicine, CBITRC, Chungbuk National University, Cheongju, Korea.

Abstract

Peak expiratory flow rate(PEF) is one of the most important diagnostic parameters in spirometry. PEF occurs in a very short duration on the forced expiratory flow signal, leading to measurement error due to non-ideal dynamic characteristic of the transducer. Therefore, the initial slope of the flow rate determines the accuracy of the measured PEF. The present study considered this initial slope as a parameter to compensate PEF. The 26 standard flow rate signals recommended by the American Thoracic Society(ATS) were flown through the air flow transducer followed by the measurements of PEF and the maximum transducer output(or pressure) value(NPEF). NPEF-PEF satisfied a quadratic curve in general, however, two signals(ATS #2, 26) having large initial slopes deviated from the curve to a significant degree. The relative error was in a linear relationship with the initial slope, thus, NPEF was appropriately compensated to provide PEF with mean relative error less than only 0.1%. The standard deviation of relative error was also less than 1/5 of the error limit of 5% recommended by ATS. Therefore, PEF can be very accurately determined by compensating the transducer output using the initial slope of the signal.

P2-2 | p346-p348 | 5월 10일 | 2층 로비

동맥 혈관의 압력-용적 모델에 기반한 위상관계 천이양상

정재희, 김명철, 예수영, 노정훈, 전계록
부산대학교 의학전문대학원 의공학과

Estimation of the phase relationship between pressure and volume based on arterial compliance model

J. H. Jung, M. C. Kim, S. Y. Ye, J. H. Ro and G. R. Jeon
Department of Biomedical Engineering, School of Medicine, Pusan National University

Abstract

In this paper, a simulation study on the phase relation between blood pressure stimulation and vessel volume change with various blood pressure waveforms on various vessel models. A general discussion of the phase mixing effect expects the shift of phase in the region of the non-linear relation between pressure and vessel compliance. In the linear and exponentially varying region, no phase shift is expected. The simulation showed both of these features under multi-frequency mixture of pressure stimulations.

P2-3 | p349-p351 | 5월 10일 | 2층 로비

맥파 신호의 특성 임피던스 관찰

유주연[1], 김명철[1], 최병철[2], 예수영[3], 김길중[4], 정동근[5], 전계록[6]
[1]부산대학교 의과대학 의공학 협동과정, [2]춘해대학 의료공학과, [3]부산대학교 의과전문대학원 BK21 사업단,
[4]동서대학교 전자공학과, [5]동아대학교 의과대학 의공학교실, [6]부산대학교 의학전문대학원 의공학교실

By detecting the characteristic impedance in pulse wave signals

J. Y. Yoo[1], M. C. Kim[1], B. C. Choi[2], S. Y. Ye[3], G. J. Kim[4], D. K. Jung[5], G. R. Jeon[6]
[1]Dept. of Interdisciplinary Program in Biomedical Engineering,Graduated School, Pusan Nati. Univ.
[2]Dept. of Biomedical Engineering, Choonhae College.
[3]BK21 Medical Science Education Center, College of Medicine, Pusan Nati. Univ.
[4]Dept. of Electronics Engineering, Dongseo Univ.
[5]Dept. of Medical Enggineering, College of Medicine, Dong-A Univ.
[6]Dept. of Biomedical Engineering, School of Medicine, Pusan Nati. Univ.

Abstract

Characteristic impedance is detecting the relationship between pressure pulse wave and PPG(photoplethysmography) signals.
The purpose of this study was the identical body region measured by means of a intergrated sensor can simultaneously record PPG signals and pressure pulse wave. Calculation of the vascular characteristic impedance using relationship between pressure pulse wave and PPG signals. (1)magnitude (2)phase (3) characteristic impedance
The result shows that same points measured correlation between pressure pluse and PPG signals.

P2-4 | p352-p354 | 5월 10일 | 2층 로비

맥파의 특징점 검출에 의한 PWV 변화 양상 관찰

김명철[1], 유주연[1], 손정만[2], 김길중[3], 정동근[4], 노정훈[5], 전계록[5]
[1]부산대학교 의과대학 의공학 협동과정, [2]춘해대학 의료공학과, [3]동서대학교 전자공학과,
[4]동아대학교 의과대학 의공학교실, [5]부산대학교 의학전문대학원 의공학교실

The study of the PWV change by detecting the cheracteristic points of the pulse wave

M. C. Kim[1], J. Y. Yoo[1], S. Y. Ye[2], G. J. Kim[3], D. K. Jung[4], J. H. Ro[5], G. R. Jeon[5]
[1]Department of Interdisciplinary Program in Biomedical Engineering,Graduated School, Pusan National University.
[2]Dept. of Biomedical Engineering, Choonhae College.
[3]Dept. of Electronics Engineering, Dongseo Univ.
[4]Dept. of Medical Enggineering, College of Medicine, Dong-A University.
[5]Dept. of Biomedical Engineering, School of Medicine, Pusan Nati. Univ.

Abstract

Pulse wave velocity has widely been used in the evaluation of atherosclerosis. In this study. We observed the change of pulse wave velocity according to characteristic points of pressure pulse waves which were recorded at brachial and tadial artery. In order to evaluate the versatility of determination of the transit time between two points of measuring site, we measured PWV in seven methods : (1) the first derivative method, (2) the second derivative, (3) the minimum, (4) the intersecting a line tangent, (5) the maximum, (6) the middle point between minimum and maximum, (7) the intersecting two line tangents. Noninvasive brachial and radial pressure waveforms were recorded in 5 volunteers. The results showed that pulse wave velocity were dependent on the characteristic points.

P2-5 | p355-p357 | 5월 10일 | 2층 로비

무구속 심박 모니터링 시스템에서의 비정상 심박동 검출에 대한 선행 연구

이효기[1], 조성필[1], 송미혜[1], 이경중[1,2]
[1]연세대학교 의공학과, [2]연세대학교 이동형응급의료정보시스템개발센터 (CEMI)

A Pilot Study of the Abnormal Heart Beat Detection for Unconstrained Heart Rate Monitoring System

H. K. Lee[1], S. P. Cho[1], M. H. Song[1], and K. J. Lee[1,2]
[1]Department of Biomedical Engineering, Yonsei University,
[2]Center for Emergency Medical Informatics, Yonsei University

Abstract

This pilot study presents a method to detect the abnormal heart beat for unconstrained heart rate monitoring system. The method is based on the rule-based that is suggested by Tsipouras et al. Beat-by-beat annotation of the MIT-BIH arrhythmia database was used to assess the algorithm performance. The results of 48 subjects indicate the sensitivity of 82.2%, specificity of 92.1% and accuracy of 91.1%. This method would be applied to abnormal heart beat detection for unconstrained heart rate monitoring such as bio-radar system.

P2-6 | p358-p360 | 5월 10일 | 2층 로비

무선 전력 전송 시스템에서 안정된 전력 공급을 위한 코일 송수신 회로의 최적화된 설계 기법

최성욱, 윤종서, 심은보
강원대학교 공과대학 기계메카트로닉스공학과

Optimizing Scheme for the Resonance Circuit Design of the Transcutaneous Energy Transmission System to Deliver Stable Electric Power

S. W. Choi, J. S. Yoon, E. B. Shim
Department of Mechanical & Mechatronics Engineering, College of Engineering, Kangwon National University

Abstract

A new transcutaneous energy transmission system is needed to maintain stable electric energy transmission for the pulsatile artificial heart. The general TET systems transmit the electric power with the two air coils without magnetic core. And, those usually used the resonance circuit to raise transmitting power. But, because the power consumption states of a pulsatile artificial heart are different at systolic and diastolic operation, those output voltages of the resonance circuits were unstable and caused the damage and failure of a pulsatile artificial heart. The optimizing scheme for the resonance circuit design has been studied to maintain output voltage of receiving coil. And, the compensating resonance circuit to reduce reactive power. To remove the noise power, we used push-pull class E amplifier as the current source. The results of experiment showed that the output voltage of receiving coil were changed within 27% during its power are changed from 0 to 150W. Its different frequency operation showed that this system reduce massive power loss caused by the reactive power.

P2-7 | p361-p363 | 5월 10일 | 2층 로비

무선 헤드셋 PPG 전송 장치

홍주현, 차은종, 이태수
충북대학교 의과대학 의공학교실

A Wireless PPG transmitter Headset

J. H. Hong, E. J. Cha, T. S. Lee
Department of Biomedical Engineering, College of Medicine, Chungbuk National University

Abstract

In this paper, a wireless PPG transmitter headset device was proposed to measure subject's photoplethysmography(PPG). PPG measures the change of infrared light intensity by the irradiated human organ, such as, finger, wrist, toe, and earlobe, etc. The device is made to be headset type for earlobe PPG recording. It has the advantage of robustness about motion artifact, which is added to finger and wrist PPG in common. Besides, it can record PPG on moving and be connected with another biomedical signal measurement device. In sitting and walking experiment, PPG signal could be recorded with minimized motion artifact. In addition, its usefulness of internal acceleration sensor was tested to detect the falling event of subject in emergent situation. Therefore, it can be used to help the elderly and mobility limited people in mobile healthcare environment.

P2-8 | p364-p366 | 5월 10일 | 2층 로비

바이오 레이더 시스템을 이용한 비접촉방식의 생체신호 측정

신재연[1], 박호동[1], 장병준[2], 이윤수[3], 이경중[1]
[1]연세대학교 의공학과, [2]국민대학교 전자공학부, [3](주) 유비즈플러스

Non-Contact Bio-signal Measurement using Bio-Radar System

J. Y. Shin[1], H. D. Park[1], B. J. Jang[2], Y. S. Lee[3], K. J. Lee[1]
[1]Department of Biomedical Engineering, Yonsei University,
[2]School of Electrical Engineering, Kookmin University,
[3]Ubizplus Co. Ltd.

Abstract

In this paper, a baseband module was designed to detect heartbeat and respiration signal without direct skin contact using an 2.4 GHz bio-radar system. The heartbeat and respiration signals acquired from I/Q channel of the bio-radar system are applied to the pre-processing circuit, the amplification circuit, and the offset circuit of the baseband module and then transmitted to PC. ECG(electrocardiogram) and reference respiration signals are measured simultaneously to evaluate the baseband module. In our experiments, heart rate accuracy was found to be very high. In this paper, we verified that the baseband module could detect heart beat and respiration well with non-contact.

P2-9 | p367-p369 | 5월 10일 | 2층 로비

박동형 생명구조장치의 동기구동 기법 개발

김종세, 최성욱
강원대학교 공과대학 기계메카트로닉스공학과

Development of Synchronous Operation Scheme for the Pulsatile ECLS

J. S. Kim, S. W. Choi
Department of Mechanical & Mechatronics Engineering, College of Engineering, Kangwon National University

Abstract

A pulsatile ECLS(Extracorporeal Life Support System) is used to maintain the blood pressure and gas concentration of patient's artery at the emergency state such as acute heart failure or cardiac arrest. The previously developed pulsatile ECLS operates regardless the patient's heart rate and it may not be beneficial to the patient. In the results of other study concerned about artificial heart and ventricular assist device, the scheme of synchronized operation with natural heart has been studied. According to the previous studies, we have developed the new synchronizing control scheme of the pulsatile ECLS that the pulse wave of the pulsatile ECLS arrived to the patient's heart when the aortic valve is closed. To detect the pulsation of the heart, the pulsatile ECLS used ECG. And, the synchronous operations and performances of the pulsatile ECLS are monitored and estimated by a microcomputer in extracorporeal experiment.

P2-10 | p370-p371 | 5월 10일 | 2층 로비

비활성 영역을 이용한 심전도 기저선의 제거에 관한 연구

조은석, 차 샘, 주장규, 이기영
관동대학교 정보통신공학과, 의료공학과, 명지대학교 전자공학과

A study on a base-line removal of electrocardiogram using inactive zone

Eun-Seuk Cho. Sam Cha, Jang-Kyu Ju, Ki Young Lee
Dept. Information Communication Eng., Biomedical Eng., Kwandong University
Dept. Electronics Engineering, Myongji University

Abstract

This paper presents a method to remove the baseline wander of ECG using slope traceing waves. At first, this method detects the point around the inactive zone after R-wave to separate the baseline wander from ECG, and linear-interpolates these points to approximate baseline wander in inactive zone, and finally, subtracts the linear-interpolated contour from the original ECG. As experimental results, this method has been applied to MIT/BIH database and compares this method with the previous method employing the difference signal between the original ECG and descending slope tracing waves[4].

P2-11 | p372-p373 | 5월 10일 | 2층 로비

손목 부착형 생체신호 모니터링 시스템

강구태[1], 정동근[1], 하정서[1], 예수영[2], 전계록[2]
[1]동아대학교 의과대학 의공학교실, [2]부산대학교 의공학협동과정

Wrist-type Wearable Health Monitoring System

G. T. Kang[1], D. K. Jung[1], J. S. Ha[1], S. Y. Ye[2], G. R.Jeon[2]
[1]Department of Medical Engineering, College of Medicine, Dong-A University,
[2]Department of Medical Engineering, Pusan National University

Abstract

In this paper, we present the development of wrist-type wearable health monitoring system. For the home healthcare application, the system requires a wearable and wireless condition. In this study, we implemented the system that could be adapted in the wrist of the patient and measure electrocardiogram (ECG), electromyogram (EMG), electrodermogram (EDG), photoplethysmogram (PPG) and acceleration (Acc). All signals were sampled in 120 Hz and displayed in LCD panel. All data were stored in SD memory and could be transmitted to PC using Bluetooth communication simultaneously. Wearable continuous health monitoring system that developed in this study could be useful in home cardiovascular health care.

P2-12 | p374-p376 | 5월 10일 | 2층 로비

심전도와 광전용적맥파를 이용한 재택형 심혈관 건강관리시스템의 설계 및 구현

송상하, 고현철, 장희원, 이정훈, 윤영로
연세대학교 의공학과

Design and Implementation of Cardiovascular Health Management System using Photoplethysmogram and Electrocardiogram

S. H. Song, H. C. Ko, H. W. Jang, J. H. Lee, Y. R. Yoon
Department of Biomedical Engineering, Yonsei University

Abstract

In this paper, cardiovascular health management system using photoplethysmogram and electrocardiogram is proposed, base on the concept of pulse transit time(PTT), pulse wave velocity(PWV). An existing cardiovascular clinical device has several defects. One of defects is too expensive for home healthcare management of cardiovascular health . Another is the complexity and hugeness of system. Thus, we suggest cardiovascular healthcare management system which is suitable to measurement cardiovascular health level at home using PTT and PWV.

P2-13 | p377-p380 | 5월 10일 | 2층 로비

와류형 호흡기류 센서의 압력-기류 특성

이인광, 최성수, 김군진, 장종찬, 김성식, 김경아, 차은종
충북대학교 의과대학 의공학교실, 충북 BIT 연구중심대학사업단

Pressure-flow relationship of the turbulent air flow transducer

In Kwang Lee, Sung Su Choi, Goon Jin Kim, Jong Chan Jang, Sung Sik Kim,
Kyung Ah Kim and Eun Jong Cha Biomedical Engineering Department, School of Medicine, CBITRC,
Chungbuk National University, Cheongju, Korea.

Abstract

Cardiopulmonary resuscitation(CPR) is an important clinical technique performing artificial ventilation and chest compression on a patient under emergent situation before arriving in hospital. Since the quality of CPR significantly affects the survival rate, it would be of great advantage to monitor respiration in real time during CPR. However, currently applied respiratory air flow transducers are difficult to apply with sensing elements in the middle of the flow axis. The present study developed a new turbulent air flow transducer conveniently applicable to CPR. Abrupt changes in diameter of the flow tube generated turbulence in air flow, thereby pressure difference is obtained to estimate the air flow rate, with no physical object on the flow plane. Expiration and inspiration were separated by the direction of the pressure difference, resulting in good symmetry. Pressure-flow relationship was tested on both quadratic and exponential models, the latter of which provided more accurate estimation results. Therefore, the present turbulent air flow transducer seemed appropriate to monitor respiration during CPR.

P2-14 | p381-p385 | 5월 10일 | 2층 로비

이벤트-레코더 기능을 가지고 있는 휠체어용 생체계측 시스템

한동균, 김종명, 차은종, 이태수
충북대학교 의과대학 의공학교실

Wheelchair type Biomedical System with Event-Recorder Function

Dong-kyoon Han, Jong-Myoung Kim, Eun-Jong Cha, Tae-Soo Lee
Department of Biomedical Engineering, College of Medicine, Chungbuk National University

Abstract

본 연구는 대상자의 생체신호(심전도, 심탄도)와 운동신호(가속도)를 동시에 측정하여 원격지 의료서버로 생체데이터를 전송할 수 있는 휠체어용 생체계측 시스템에 관한 것이다. 이 장치는 휠체어를 타고 이동 또는 쉬고 있는 피실험자의 생체신호와 운동신호를 동시에 측정하고, 측정된 신호를 CDMA망을 통해 원격지 서버로 동시에 전송할 수 있는 시스템 구축에 목적을 두고 제작되었다. 이 장치는 신체영역통신망과 원격의료서버로 구성되어 있다. 신체영역통신망은 생체신호와 운동신호를 동시에 획득하고 이벤트 발생시 CDMA망을 통하여 원격의료서버로 데이터를 전송할 수 있도록 설계하였다. 원격의료서버는 신체영역통신망에 전송한 이벤트 데이터를 실시간으로 디스플레이 하도록 설계되었다. 개발된 시스템의 성능평가를 위해 두 가지 실험을 하였다. 첫 번째로, 이벤트 발생 시 배터리 소모시간을 검증하였고, 두 번째로, 이벤트 발생 시 원격지 서버로 생체 데이터가 정확하게 전송되는지를 검증하였다. 개발된 장치를 이용하여 첫 번째 실험 결과, 16번의 이벤트를 발생시켜 약 29시간동안 배터리가 안정적으로 동작하는 것을 확인할 수 있었다. 두 번째 실험 결과, 이벤트 발생 시 해당 데이터가 CDMA망을 통해 원격지 의료서버로 정확하게 전송된 것을 확인할 수 있었다. 이 시스템은 휠체어를 타고 다니는 사람들의 건강을 돌볼 수 있는 시스템으로 사용할 수 있을 것이며, 이동형 헬스 케어 시스템에 사용할 수 있을 것으로 사료된다.

P2-15 | p386-p389 | 5월 10일 | 2층 로비

자동 혈압측정기기의 능동적 가/감압 목표치 설정을 위한 가압단계 MAP 추정

오홍식[1], 지영준[1], 이종실[1], 김영수[2], 김인영[1], 김선일[1]
[1]한양대학교 학과간협동과정 의용생체공학과, [2]한양대학교 의과대학 신경외과

Estimation of Mean Arterial Pressure for Smart Inflation / Deflation in Automatic Blood Pressure Measurement Devices

H. S. Oh[1], Y. J. Chee[1], J. S. Lee[1], Y. S. Kim[2], I. Y. Kim[1] and S. I. Kim[1]
[1]Department of Biomedical Engineering, Hanyang University,
[2]Department of Neurosurgery, College of Medicine, Hanyang University

Abstract

The cuff is inflated until the artery is completely occluded and further released the pressure until lower than diastolic pressure. However, controller is working without know appropriate pressure, because it's impossible to know the appropriate pressure that press the artery before complete to measure blood pressure.

In this study, we make a NIBP devices which apply an estimation of Mean Arterial Pressure in Inflation Phase

P2-16 | p390-p394 | 5월 10일 | 2층 로비

전동휠체어용 생체계측 시스템의 성능평가

한동균, 김종명, 홍주현, 차은종, 이태수
충북대학교 의과대학 의공학교실

Performance evaluation of biosignal measurement at the auto-wheel chair system

Dong-kyoon Han, Jong-Myoung Kim, Joo-Hyun Hong, Eun-Jong Cha, Tae-Soo Lee
Department of Biomedical Engineering, College of Medicine, Chungbuk National University

Abstract

The purpose of this study is to heart rate and respiratory rate detection by developed device that can measure ECG and BCG of a subject on moving or resting wheelchair. In order to acquire ECG and BCG, the system has an amplifier for each signal, and records the A/D converted signals on a SD card. In addition, it is equipped with a 3-axis acceleration sensor to remove motion noises that may happen while driving the wheelchair and the data is also stored in the SD card. If an event takes place in the subject, biomedical signal data recorded in the SD card is transmitted to a remote server using a CDMA module (BSM-860s of Bellwave Co.). In this study , two experiments were performed to measured by respiratory rate of the developed device. for the heart rate were measured using the Biopac device (reference device) compared to accuracy at the developed device. In order to evaluate the usefulness of the developed device was eight subject to experiment to proceed. the results of an experiment to measure the heart rate were measured ECG and the BCG were measured Respiratory rate, which measures the comparative analysis. If an event takes place in the subject, 48 Kbyte data recorded in the SD card for the last 32 seconds is transmitted to a remote server using a CDMA module. The program of remote server was developed using Microsoft C# language so that the received ECG, BCG and 3-axis acceleration data be displayed on its screen. In conclusion, this study developed a system that acquires both heart rate were measured ECG and BCG were measured respiratory rate simultaneously from subject on wheelchair and, on the happening of an event, transmits the data to a remote server through CDMA network

P2-17 | p395-p398 | 5월 10일 | 2층 로비

착용형 생체신호계측 단말장치

홍주현, 차은종, 이태수
충북대학교 의과대학 의공학교실

Wearable Biomedical Signal Measurement Terminal

J. H. Hong, E. J. Cha, T. S. Lee
Department of Biomedical Engineering, College of Medicine, Chungbuk National University

Abstract

In this study, a belt type wearable terminal was developed to measure subject's biomedical signal and transmit the data to remote medical server. The terminal was developed to measure and record biomedical signal continuously in daily life and transmit the data to remote server through CDMA cellular phone network and inform remote doctor in emergent situation. It consists of three parts, such as, biomedical signal acquisition, data recording, and transmission part. The biomedical signal acquisition part was made to measure subject's ECG and motion signal continuously. The data recording part is to store biomedical data on built-in SD card. The transmission part is to transmit the emergent data to remote server through built-in CDMA module in case of wearer's heart and motion problem. In laboratory experiment, the recorded data on button press event was transmitted to remote medical server through cellular phone network accurately. This function is a merit of the developed device, comparing with commercial ECG Holter monitor. Besides, this device has the function of Holter monitor, event recorder, and motion signal monitor. Therefore, it can help the aged people and chronic disease patients in aged society.

P2-18 | p399-p401 | 5월 10일 | 2층 로비

측정 자세에 따른 Pulse Wave 파라미터의 변화에 관한 연구

김은근, 허현, 남기창, 허영
한국전기연구원

A Study on Pulse Wave Parameter Change According to Measurement Position

E. G. Kim, H. Huh, K. C. Nam, Y. Huh
Korea Electrotechnology Research Institute

Abstract

In this study, pulse wave parameters change were verified. To measure pulse wave in radial artery, noninvasive tonometric pulse wave measurement device (SphygmoCor PX, AtCor, Austrailia) was used. And 10 parameters for pulse wave analysis were evaluated according to measurement positions; stand, sit and supine. As a result, t1, t2, and ED in stand position were less than in sit and supine position. And HR and SEVR in stand position were higher than in sit and supine position.

P2-19 | p402-p405 | 5월 10일 | 2층 로비

퍼지 논리를 이용한 인체 활동량 및 체온의 변화에 따른 심장 박동수 예측 전문가 시스템 구현

신광수, 김진권, 이병우, 이명호
연세대학교 공과대학 전기전자공학과

Implementation of Expert System predicting for Heart Rate according to Body Activity and Body Temperature Fuzzy Logic

K. S. Shin, J. K. Kim, B. W. Lee, and M. H. Lee
Department of Electrical and Electronics, Yonsei University

Abstract

Fuzzy is difficult to analyzing combining and executing except artificial intelligent programming because input conditions and combination conditions are ambiguous. But Fuzzy is able to express human's peculiar experiment and knowledge. So Fuzzy System give hand to solve the medical decision problem. This solution using fuzzy logic is available on patients based on Medical Doctor's expert knowledge. This paper is the thing that is implemented to simulate expecting Heart Rate according to degree of patient's Body Temperature and Body Activity and comparing to test input heart rate signal.

The most widely used method for rate-adaptive pacemakers for predicting of Heart Rate Control is to sense body temperature and movements.[1],[2] This simulator is made as purpose using expert system for medical doctor and in the future, eventually noticed to patients about his condition based on setting by medical doctor as one of the u-health technology.

P2-20 | p406-p409 | 5월 10일 | 2층 로비

Hierarchical classification을 이용한 부정맥 자동진단 알고리즘의 성능향상

이도훈[1], 조백환[1], 박관수[1], 송수화[1], 이종실[1], 지영준[1], 김인영[1], 김선일[1], 김영수[2]
[1]한양대학교 의용생체공학과, [2]한양대학교 의과대학 신경외과

Improved Arrhythmia classification using hierarchical classification

D. H. Lee[1], B. H. Cho[1], K. S. Park[1], S. H. Song[1], J. S. Lee[1], Y. J. Chee[1], I. Y. Kim[1], S. I. Kim[1], Y. S. Kim[2]
[1]Dept. of Biomedical Engineering, Hanyang University,
[2]Dept. of Neurosurgery, College of Medicine, Hanyang University

Abstract

In this paper, we proposed the hierarchical classification for arrhythmia detection with 21 input features based on RR-interval and morphology. After the preprocessing ECG beats, the four type of beats obtained from MIT-BIH Arrhythmia ECG data was classified by SVM(Support Vector Machine) with RBF kernel.

In classification perpormance, hierarchical classification can reduce trade-off effect between such class N, S, V, F

P2-21 | p410-p413 | 5월 10일 | 2층 로비

PPG 신호처리를 이용한 호흡수 검출 연구

이은미, 김내현, 웬튀창, 홍주현, 차은종, 이태수
충북대학교 의공학교실

A Study on Respiratory Rate Detection by PPG Signal Processing

E. M. Lee, N. H. Kim, N. T. Trang, J. H. Hong, E. J. Cha, T. S. Lee
Department of Biomedical Engineering, College of Medicine, Chungbuk National University

Abstract

Photoplethysmography offers the clinically meaningful parameters, and includes the helpful information for respiratory rate detection. In this study, we presented three respiratory signal detection algorithms using photoplethysmography raw data generated from TSD123A sensor : (1)Min-Max (2)Peak-to-Peak (3)Pulse Shape.

As reference signal, nasal sensor signal was acquired simultaneously and compared and analyzed. We used two types of moving average filtering technique to process PPG signal. In laboratory experiment, 6 subjects' PPG signals were measured when they respire ten and fifteen times, and free times per minute.

From the results, I concluded that Min-Max and Peak-to-Peak algorithms perform better than Pulse shape algorithm. Min-Max and Peak-to-Peak algorithms can be used to detect respiratory rate. But, Pulse Shape algorithm was accurate for subject 4 only. In the future, I will obtain more experimental data and improve the accuracy and reliability.

P2-22 | p414-p416 | 5월 10일 | 2층 로비

Sevoflurane 마취 중 pulse transit time변화에 따른 교감신경계의 효과

예수영[1], 백승완[2], 김태균[2], 김길중[3], 남기곤[4], 정동근[5], 전계록[6]
[1]부산대학교 의과전문대학원 BK 사업단, [2]부산대학교 의학전문대학원 마취통증의학교실,
[3]동서대학교 전자공학과, [4]부산대학교 전자공학과, [5]동아대학교 의공학교실, [6]부산대학교 의학전문대학원 의공학교실

The effect of the sympathetic nervous system according to pulse transit time during sevoflurane anesthesia

S. Y. Ye[1], S. W. Baik[2], T. K. Kim[2], G. J. Kim[3], K. G. Nam[4], D. K, Jung[5], G. R. Jeon[6]
[1]BK21 Medical Science Education Center, College of Medicine, Pusan Nati. Univ.
[2]Dept. of Anesthesia and pain medicine, College of medicine, Pusan Nati. Univ.
[3]Dept. of Electronics Engineering, Dongseo Univ.
[4]Dept. of Electronics Engineering, Pusan Nati. Univ.
[5]Dept. of Medical Engineering, College of Medicine, Dong-A Univ.
[6]Dept. of Biomedical Engineering, School of Medicine, Pusan Nati. Univ.

Abstract

The relation between stiffness of the blood vessel and ANS(autonomic nervous system) is observed by comparing the distribution of the PSD and the change of the PTT appeared the stiffness of the blood vessel at the pre-anaesthesia, sevoflurane anaesthesia and intubation after states. In this paper, PSD of the HRV well-known of the index of the ANS activity reflected the ANS activity according to anesthesia stages. Effect of LF during the anesthesia is similar to PTT changes. This means that PTT analysis is useful index reflecting the body state because of well appearing the ANS activity during svoflurane anestheisa. And this analysis is useful because the calculating method is simple and time is short compare with the method of HRV PSD.

P2-23 | p417-p420 | 5월 10일 | 2층 로비

가속도센서와 자이로센서를 이용한 낙상 알고리즘

박진[1], 김용욱[2], 김동욱[3], 김남균[3]
[1]전북대학교 대학원 헬스케어공학과, [2]전북대학교 헬스케어 기술 개발 사업단, [3]전북대학교 공과대학 바이오메디컬공학부

Development of the algorithm for fall detection using accelerometer and gyroscopes

J. Park[1], Y. W. Kim[2], D. W. Kim[3], N. G. Kim[3]
[1]Dept. of Healthcare Engineering, Chonbuk National Univ.
[2]Center for healthcare technology development.
[3]Division of Biomedical Engineering, Chonbuk National Univ.

Abstract

Social activities of the elderly have been increasing as our society progresses toward an aging society. As their activities increase, so does the occurrence of falls that could lead to fractures. Falls are serious health hazards to the elderly. Therefore, development of a device that can detect fall accidents and prevent fracture is essential. In this study, a fall detection device has been developed utilizing acceleration sensors and gyroscopes. Angular velocities in two major axes of the body were measured by two gyroscopes that are oriented in right angles to each other. Linear accelerations were measured using three axes accelerometers. To detect a fall based on the sensor data in real-time, a fall detection algorithm has been devised in LabVIEW 8.0(Natioanl InstrumentsTM). The devised algorithm has been verified based a series of fall experiments and the success rate has been found to be 92 %.

P2-24 | p421-p424 | 5월 10일 | 2층 로비

각근력 측정이 가능한 전자 브레이크 엔진의 제작과 각근력 측정 알고리즘 설계 및 구현

서상진, 전윤진, 손대흥, 박승훈
경희대학교 전자정보대학 동서의료공학과

Design and Implementation of a Brake Engine for Measuring the Muscular Strength and Measurement Algorithm

S. J. Seo, Y. J. Jeon, D. H. Son, S. H. Park
Dept. of Biomedical Eng. College of Electronics and Information, Kyung Hee University

Abstract

In this paper we have proposed a system for measuring the muscular strength of legs. The system is based on an electromagnetic brake which measure the muscular strength of leg individually. While pedalling the load will be transmitted to the loadcells. The loadcells will be bended by the load amount. From the result of loadcell ADC we can measure the muscular strength of separate legs. Additionally, the system can check pedalling speed for per 60 degree rotation and devide the load between the legs. Through the three sensor data we can measure angular speed and torque. We have designed firmware based on windows environment to detect Hall Sensor and Proximity Sensor signals. C++ has been used to display the result of signal detection.

P2-25 | p425-p426 | 5월 10일 | 2층 로비

고휘도 녹색 LED 광원이 골수 및 조직 세포 증식에 미치는 효과

천민우[1], 김성환[1], 박용필[2], 김영표[2], 유성미[3], 김태곤[4]
[1]조선대학교 의과대학 의학과, [2]동신대학교 보건복지대학 병원의료공학과, [3]광주보건대학 간호과, [4](주)바이오아테코 인공장기 연구소

The Effect of high brightness green color LED light irradiation on bone marrow and tissue cell proliferation

M. W. Cheon[1], S. H. Kim[1], Y. P. Park[2], Y. P. Kim[2], S. M. Yu[3] and T. G. Kim[4]
[1]Dept of Medicine, Chosun University.
[2]Dept of Hospital Biomedical Engineering, Dongshin University.
[3]Dept of nursing, Gwangju Health College. [4]Artificial Organs Institute, Bioateco INC.

Abstract

The study examined what effects 525nm LED causes to bone marrow and tissue cell of SD-Rat when LED characterized cheap and safe is used onto the light therapy by replacing the low level laser. We developed the equipment palpating cell proliferation using a high brightness LED. MTT assay method was chosen to verify the cell increase of two groups and the effect of irradiation on cell proliferation was examined by measuring 590nm transmittance of ELISA reader. As a result, the cell increase of Rat bone marrow and tissue cells was verified in irradiation group as compared to non-irradiation group.

P2-26 | p427-p430 | 5월 10일 | 2층 로비

다자세 제어가 가능한 휠체어용 의자의 설계

배주환, 문인혁
동의대학교 메카트로닉스공학과

Design of Seat Mechanism for Multi-postures-controllable Wheelchair

J. H. Bae and I. Moon
Department of Mechatronics Engineering, Dong-Eui University

Abstract

This paper presents a kinematic analysis for a wheelchair controllable multi-postures. The available postures are reclining, tilting, standing, and elevation, which are performed by controlling four linear actuators. The standing function is controlled by extending the backrest and the leg-rest of the seat synchronously. To optimize the seat posture into the human body structure, the linear actuators is controlled independently. Simulation results using a seat model proposed in this study show that the proposed seat mechanism is applicable to a wheelchair controllable multi-postures.

P2-27 | p431-p433 | 5월 10일 | 2층 로비

바이오센서 개발을 위한 $CuPc/C_{60}$ 이중층을 이용한 유기 광기전 소자의 전기적 특성

이호식[1], 천민우[2], 유성미[3], 박용필[1]
[1]동신대학교 병원의료공학과, [2]조선대학교 의학과, [3]광주보건대 간호학과,

Electrical Properties of Organic Photovoltaic Cell using $CuPc/C_{60}$ double layer for Biosensors Development

H. S. Lee[1], M. W. Cheon[2], S. M. Yu[3], Y. P. Park[1]
[1]Dept. of Hospital and Biomedical Engineering, Dongshin University
[2]Dept. of Medical, Chosun University
[3]Dept. of Nursing, Gwangju Health College

Abstract

Organic photovoltaic effects were studied in a device structure of ITO/CuPc/Al and ITO/CuPc/C_{60}/BCP/Al. A thickness of CuPc layer was varied from 10 nm to 50 nm, we have obtained that the optimum CuPc layer thickness is around 40 nm from the analysis of the current density-voltage characteristics in CuPc single layer photovoltaic cell. From the thickness-dependent photovoltaic effects in $CuPc/C_{60}$ heterojunction devices, higher power conversion efficiency was obtained in ITO/20nm CuPc/40nm C_{60}/Al, which has a thickness ratio ($CuPc:C_{60}$) of 1:2 rather than 1:1 or 1:3. Light intensity on the device was measured by calibrated Si-photodiode and radiometer/photometer of International Light Inc(IL14004).

P2-28 | p434-p435 | 5월 10일 | 2층 로비

산소포화도 측정기의 Central Monitoring System 구현

김종철[1], 권예원[1], 조신희[1], 정현애[1], 정석범[1], 기선우[1], 천승민[1], 서기홍[1], 권혁남[1], 김병태[2]
[1]삼성서울병원 의공학과, [2]성균관대학교 의과대학

Implementation of the pulse oximeter central monitoring system

J.C. Kim[1], Y.W. Kwon[1], S.H. Cho[1], H.A. Jeong[1], S.B. Jung[1], S.W. Ki[1], G.H. Seo[1], H.N. Kwon[1] and B.-T. Kim[2]
[1]Dept. of Medical Engineering, Samsung Medical Center, [2]Sungkyunkwan University School of Medicine

Abstract

With a development of computer and network technology, medical equipment have grown remarkably. Recently, they have became various output signals. they are connected with Electronic Medical Record(EMR) in the hospital.

In this paper, we implement the central monitoring system(CMS) of the pulse oximeter. It presents the example of the CMS construction among the small size medical equipment that support the RS232C output.

P2-29 | p436-p437 | 5월 10일 | 2층 로비

세포내 미토콘드리아의 대사 활성을 위한 레이저 조사장치의 개발

김유석, 심은보, 최성욱
강원대학교 기계메카트로닉스 공학부

Development of the Laser Irradiation System for Incsrease Mitochondrial Metabollism

Y. S. Kim, E. B. Shim, S. W. Choi
Department of Mechanical & Mechatronics Engineering, Kangwon National University

Abstract

An intracellular organelle that generates internal energy, mitochondria is involved in the metabolism of glucose and fatty acid. The team of S. Passarella (1984) in Italy confirmed that ATP synthesis increased and metabolism was activated when mitochondria extracted from liver cells of rats and irradiated He-Ne laser(wavelength 632.8 nm) with the output of 5 J/cm2. Therefore, it is expected that when mitochondria in myocytes will be activated and internal metabolism will be promoted if we irradiate a laser with a similar wavelength as the He-Ne laser over the muscular muscle skin of a patientwith metabolic syndrome who has low glucose decomposition rate. The purpose of this study is to develop a laser control system which can irradiate a 570~650 nm laser uniformly 3-4 mm under the human skin using a semiconductor laser array to activate mitochondria. Furthermore, to check if the He-Ne laser can have sufficient output (5 J/cm2) even after passing through a 5mm skin outside human skin, we measured the intensity of radiation that penetrates through a 5mm-thick porcine skin.

P2-30 | p438-p441 | 5월 10일 | 2층 로비

심박보조 장비 개발을 위한 EMG 시뮬레이터

박현철, 김진권, 이충근, 신항식, 정완진, 이명호
연세대학교 전기전자공학과

EGM Simulator development for Heart assistance device

° H. C. Park, J. K. Kim, C. K. Lee, H. S. Sin, W. J. Jeong, and M. H. Lee
Department of Electrical and Electronic Engineering, Yonsei University

Abstract

This paper propose a EGM Simulator which can alternate clinic experiment when we develop a implantable heart assistance device. The objective of this paper is that making fast and accurate development of arrhythmia algorism for ICD is by using recombined EMG signal. Feature vector for discrimination is different each other, because recombined signal is obtained from random patient. To solve these kind of problems, EGM Simulator use Normalization and bezier curve theory to manage a boundary. Through this preprocess, EGM Simulator generates new heart signal from different signals. Tester can make test vector for testing and checking heart assistance device's accuracy. The result of this study are EGM database manager, EGM signal generator, EGM signal display and peak detector.

P2-31 | p442-p445 | 5월 10일 | 2층 로비

외이도에 마이크로폰을 이식하는 완전 이식형 인공중이에서의 음향 궤환 현상을 고려한 마이크로폰 이식 위치 결정

김동욱[1], 성기웅[1], 김민우[1], 이장우[1], 정의성[1], 임형규[1], 이정현[2,3], 조진호[1,2,3]
[1]경북대학교 대학원 전자전기컴퓨터학부, [2]경북대학교병원 의공학과, [3]경북대학교 첨단 감각기능 회복장치 연구센터

Determination of Microphone's Location Considering Acoustic Feedback at Fully Implantable Middle Ear Hearing Device with Auditory Canal Implant Type Microphone

D. W. Kim[1], K. W. Seong[1], M. W. Kim[1], J. W. Lee[1], E. S. Jung[1], H. G. Lim[1], J. H. Lee[2,3], and J. H. Cho[1,2,3]
[1]School of Electrical Engineering and Computer Science, Kyungpook National University,
[2]Department of Biomedical Engineering, Kypungpook National University Hospital,
[3]Advanced Research Center for Recovery of Human Sensibility, Kyungpook National University

Abstract

Nowadays, implantable hearing aids have been developed to solve problems of conventional hearing aids. Among these devices, fully implantable hearing devices need an implantable microphone which is placed in the temporal bone or in the auditory canal to received sound signal. If the microphone is implanted in the auditory canal, the microphone input sound can be increased by the resonance characteristic of the auditory canal and the horn collecting sound effect of the pinna.

However, the acoustic feedback can be produced because of the sound transmission and vibration in reverse direction from the tympanic membrane to the auditory canal. The howling effect caused by the acoustic feedback should be considered.

In this paper, amount of the acoustic feedback is measured as the changing the placement of microphone in the auditory canal using a physical ear model which is similar to acoustical and vibratory properties of the human ear. Through the measured value, location of implanteble microphone can be determined on value to minimize the acoustic feedback.

P2-32 | p446-p447 | 5월 10일 | 2층 로비

유비쿼터스 헬스시스템에서의 이중 무선채널을 통한 생체신호 모니터링 개선

최경호, 허영정, 전병우, 박찬오, 차용대, 윤길원
서울산업대학교 의료전자연구소

Improvement of biosignal monitoring in an u-Health system based on dual wireless network lines

K. H. Choi, Y. J. Huh, B. W. Joen, C. O. Park, Y. D. Cha, and G. Yoon
Institute for Biomedical Electronics, Seoul National University of Technology

Abstract

In this paper, we introduced an ubiquitous health monitoring system based on dual wireless network lines. This system, in the normal mode, gathers minimal real-time data which are vital signs such as heart rate, respiratory rate, body temperature and pulse transit time, etc from a large number of subjects. However, when monitored vital signs of particular patient or patients become abnormal, full biosignal data including real-time waveform of ECG and others are transmitted to a health care server through an additional wireless channel. Our proposed system can handle a large number of people and a full biosignal monitoring for specific patients, if necessary, is provided at the same time.

P2-33 | p448-p451 | 5월 10일 | 2층 로비

의료 환경에서 사용되는 의료기기 Risk Management 방안

오주현[1], 신택수[1], 김종순[1], 김서확[1], 신동익[2], 허수진[2]
[1]서울아산병원 의공학과, [2]울산대학교 의과대학 의공학교실

The method of risk management activities applied in medical center

oJ.H.Oh[1], T.S.Shin[1], J.S.Kim[1], S.H.Kim[1], D.I.Shin[2], S.J.Huh[2]
[1]Department of Biomedical Engineering, Asan Medical Center, [2]University of Ulsan, College of Medicine

Abstract

In modern medical equipment, maintenance and RM(risk management) has taken important portion in medical centers. RM was that it has controlled and prepared the risk. The ISO 14971 is a national standard about RM and is used in Korea, US, EU and advanced countries.

So, it is necessary to control the risk through the production, plan and application for medical equipment.

It is expected that RM activities applied in medical center will make it possible to manage of medical equipment in medical center.

P2-34 | p452-p456 | 5월 10일 | 2층 로비

인간공학적 요소를 적용한 드럼식 세탁기 디자인 개발 시 제시된 요소들의 영향 평가

조영근[1,2], 김현동[1,2], 최현호[3], 강기영[4], 임도형[1,2], 김한성[1,2]
[1]연세대학교 의공학과, [2]연세대학교 의료공학연구원, [3]U&I Corp., [4]LG Corp.

Estimation of Suggestion Factors to be considered for Ergonomical Washin Machine design through Biomechanical Methodology

Y.K. Cho[1,2], H. D. Kim[1,2], H. H. Choi[3], K. Y. Kang[4], D. Lim[1,2], H. S. Kim[1,2]
[1]Department of Biomedical Eng., [2]Institute of Medical Eng., [3]Yonsei University U&I Co., [4]LG Corp.

Abstract

Recently, number of old person and disabled person with musculoskeletal disorder rapidly go on increasing in our society. Many studies have reported the fact that an excessively accumulated burden induced from physical labor conducted routinely in home and industry can be one of main reasons. Efforts to identify jobs or tasks having known risk factors for work-related musculoskeletal disorder can provide the groundwork for changes aimed at risk reduction, and it is reasonable to design the proper appliance. Actually, the research is now under way actively. However, existing study depend on questionnaire survey. This method is not objective validity in justification for the research results. So, we conduct an experiment of the correlation between drum-washing machine and loads on each part of human body in 3-dimensional motion capture and biomechanics. In this experiment the value of muscle strengths and joint moments of lower-body decrease in case of using new machinery raised in 15cm. These results may indicate that muscloskeletal disorder is reduced when using new drum-washing machine with proper human factor.

P2-35 | p457-p460 | 5월 10일 | 2층 로비

인간공학적 요소를 적용한 청소기 디자인 개발 시 고려되어야 할 사항 제시

조영근[1,2], 김현동[1,2], 최현호[3], 강기영[4], 임도형[1,2], 김한성[1,2]
[1]연세대학교 의공학과, [2]연세대학교 의료공학연구원, [3]U&I Corp., [4]LG Corp.

Suggestion of Factors to be considered for Ergonomical Cleaner design through Biomechanical Methodology

Y.K. Cho[1,2], H. D. Kim[1,2], H. H. Choi[3], K. Y. Kang[4], D. Lim[1,2], H. S. Kim[1,2]
[1]Department of Biomedical Eng., [2]Institute of Medical Eng., [3]Yonsei University U&I Co., [4]LG Corp.

Abstract

Recently, many studies have reported the fact that an psychological and physical burden induced from physical labor conducted routinely can be one of main reasons of musculoskeletal disorders in the working population. The current study was therefore performed to suggest which biomechanical factors should be considered to reduce a risk of the musculoskeletal disorders in ergonomic point of view.

For this, cleaning work was chosen and examined because the work generally included pushing and pulling works. A survey, rapid entire body assessment (REBA) and three-dimensional motion analysis by using musculoskeletal models were performed and analyzed.

From these results, it can be concluded that a risk of the musculoskeltal disorders, which may be induced by a repetitive cleaning work, may be reduced through considering our findings in cleaner design improvement. Also, it is thought that if our findings can be applied for improvement of working environment, a possibility of occurrence of the musculoskeletal disorders by the pushing and pulling works may be reduced highly.

P2-36 | p461-p462 | 5월 10일 | 2층 로비

입력전원이 의료용 X-선 고전압장치에 미치는 전원특성 시험

김영표[1], 박용필[1], 이호식[1], 천민우[2], 김태곤[3]
[1]동신대학교 보건복지대학 병원의료공학과, [2]조선대학교 의과대학 의학과, [3](주)바이오아테코 인공장기연구소

Electric power characteristic test of diagnostic X-ray high voltage transformer by input power condition

Y. P. Kim[1], Y. P. Park[1], H. S. Lee[1], M. W. Cheon[2] and T. G. Kim[3]
[1]Department of Hospital Biomedical Engineering, Dongshin University
[2]Department of Medicine, Chosun University, [3]Artificial Organs Institute, Bioateco INC.

Abstract

Diagnostic X-ray high voltage transformer needs high voltage input power when operated, if electric power conditions are not suitable, could not use diagnostic X-ray high voltage transformer or could not use normally by abnormal working. If diagnostic X-ray system operated with abnormally by electric power conditions, it cause of difficulty of patient diagnosis. And we used auxiliary power with battery to operate diagnostic X-ray high voltage transformer without using normal electric power. We made one system after designing of new electric circuit and we compared normal power X-ray system with battery powered X-ray system by described method in this thesis. And then we found characteristic and efficiency of diagnostic X-ray high voltage transformer by different input power condition.

P2-37 | p463-p466 | 5월 10일 | 2층 로비

저에너지 방사선 측정을 위한 CsI(Tl) 섬광검출기 특성실험 장치

심상현[1], 진계환[1], 이상복[1], 이준행[1], 이삼열[1], 이태수[2]
[1]남북대학교 방사선학과, [2]충북대학교 의과대학 의공학교실

Development of CsI(Tl) Scintillation Counter for Measurement of Low Energy Radiation

S. H. Sim[1], G. H. Jin[1], S. B. Lee[1], J. H. Lee[1], S. Y. Lee[1] and T. S. Lee[2]
[1]Department of Radiology, Nambu University,
[2]Department of Biomedical Engineering, Chungbuk National University Medical School

Abstract

Since Roentgen discovered X-ray in 1895 and Becquerel did uranium in 1896, the use of radiation has been increasing for improving and maintaining human health. In order to minimize patients' and radiation related workers' exposure to radiation and prevent the harmful effects of radiation, it is very important to measure radiation dose, radiation dose rate and energy accurately and precisely. Among existing radiation detectors, first, products that can measure dose rate and energy are too large in size to carry and expensive. Second, Geiger-Mueller-Tube used commonly as a survey meter cannot measure radiation energy. Third, it is not easy to measure low energy radiation. The present study implemented a CsI (Tl) scintillation detector characteristic analysis system for measuring low energy below 100 keV, and examined the energy spectrum.

P2-38 | p467-p470 | 5월 10일 | 2층 로비

정적인 자세의 동요분석을 위한 장치와 알고리즘

박장호, 서상진, 손대흥, 박승훈
경희대학교 전자정보대학 동서의료공학과

Device and Algorithm for Analysis of Static Postural Sway

J. H. Park, S. J. Seo, D. H. Son and S. H. Park
Dept. of Biomedical Eng. College of Electronics and Information, Kyung Hee University

Abstract

In this paper, we present a device for center of pressure(COP)-based measurement of static posture and algorithm of COP analysis. For accurate measurement of COP, 4 loadcell of high precision are used and each pressure from subject's 4 area which are left-foot-front, left-foot-rear, right-foot-front and right-foot-rear is measured independently. Electrical signal from each loadcell is amplified by differential amplifier and quantified by A/D converter. Numerical value of pressure is calculated using reference value which was determined in calibration process. COP is derived through resultant force calculation about pressure values from each area. Algorithm, analyzing COP record, provides basic parameters such as deviation of COP, length and velocity and envelope area of COP-trajectory, direction and frequency and intensity of movement of COP trajectory for sway analysis. These parameters can be applicable to obtaining other critical parameters for better understand of postural sway. Application PC program for calibration and implementation of sway-analysis algorithm is written in C++ language.

P2-39 | p471-p474 | 5월 10일 | 2층 로비

태권도 품새의 신체활동 분석

이상복, 홍주현, 차은종, 이태수
충북대학교 의과대학 의공학교실

Analysis of Physical Activities in Taekwondo Pumsae

S. B. Lee, E. J. Cha, J. H. Hong, T. S. Lee
Department of Biomedical Engineering, College of Medicine, Chungbuk National University

Abstract

xercise is very important element for successful aging. Among many sports events, Korea is the suzerain of Taekwondo. When competing (Taekwondo Free Fighting) after learning Poomse as basic movements and inuring them, people compete with movements depending on situation. Among Poomses of Taekwondo, Taegeuk Poomse consists of very basic movements from 1 Jang to 8 Jang and they are for inuring to body. In order to prescribe Taegeuk Jang, which is the basic movement of Taekwondon that Korea is the suzerain, as an excercise for successful agin, it is necessary to analyze physical activity level of each Taegeuk Jang (From 1 Jang through 8 Jang) and suggest the same. Therefore, in this study, I analyzed physical activity level of each Jang of Taegeuk Poomse by attaching Armband made by Body Media Company on brachia and legs! below knee of Taekwondo trainees. The result of the analysis of the whole momentum from Taegeuk 1 Jang to 8 Jang is as follows : First, the average absolute value of acceleration variation of vertical direction signal (L-MAD) : 5.15. Second, the average absolute value of acceleration variation of horizontal direction signal(T-MAD) : 3.44. Finally, the average of calorie consumption per minute (AEE/Min) : 5.06 Cal. The obtained result corresponds to proper exercise condition for successful aging and it can be utilized as data for excercise prescription for the young and the old.

P2-40 | p475-p477 | 5월 10일 | 2층 로비

피부조직에서의 와전류 분포 분석 시뮬레이션

조동국, 이균정, 신태민
연세대학교 보건과학대학 의공학과

Analysis of Eddy Current Density in Human Skin Tissue

D. G. Cho, Q. J. Lee, T. M. Shin
Department of Biomedical Engineering, College of Health Science, Yonsei University

Abstract

There are three ways to treat body with the oriental medical science.- acupuncture, moxibustion and drugtreatment. Effect of acupuncture makes flow of energy smooth. Acupuncture also known as electric stimulus.

Consequently, in this paper, it has compared the magnetic flux density with simulation result and real(actual) figure-of-eight(FOE) coil to confirm possibility which can cause electronic stimulus of acupuncture with transcranial magnetic stimulation(TMS). And it has analyzed eddy current distribution in the human skin model with finite-element method.

It has been decided twenty-one points which are 2 dimension which is located lower real FOE coil to compare the magnetic flux density with simulation result and real FOE coil.

On the X axis there is 20cm FOE coil and twenty one measurement points. On the Y axis there are three measurement points which are 1cm, 2cm, and 3cm below the FOE coil. At 63 points the flux density was recorded.

The human skin model is composed stratum corneum, cuticle, corium, fat and muscle layer. It uses FOE coil to focus eddy current

It has been found that magnetic flux density is localized at center of FOE coil, and simulation result has gotten a same result.

In the result of simulation with human skin model, it has been confirmed that eddy current is localized at small part of skin which is corresponded to FOE.

Consequently, it is considered that it is possible to make electronic effect of acupuncture with eddy current which is occured from skin.

P2-41 | p478-p481 | 5월 10일 | 2층 로비

헬스케어로봇을 위한 공통 인터페이스 기술의 개발

양용주, 문동주, 이성일
한국생산기술연구원 로봇기술본부 제어•인식팀

Development of Common Interface Technology for Healthcare Robot

Y. J. Yang, D. J. Moon, S. I. Yi
Control & Perception Research Team, Division for Applied Robot Technology, Korea Institute of Industrial Technology (KITECH)

Abstract

Healthcare robot technology is one of the biggest issues in the robotics field, and many companies and institutes have sought to develop a healthcare robot technology.

The healthcare robot must have certain abilities that would allow it to help a person mentally and/or physically. There is no common interface module, however, for healthcare robot platforms, and few robots that have healthcare abilities exist. Therefore, developing a common interface technology and applying the technology to robot platforms can pave the way for the development of a technology that could improve the physical and mental health of humans.

This paper introduces the authors' research on a common interface module and a healthcare service robot platform. First, a common interface module is one that can be used in common in the healthcare robot area. The research on a common interface module contains the following technologies: biosignal processing modules; voice signal processing modules, which could recognize voice commands; and a human-friendly design for a healthcare system.

P2-42 | p482-p485 | 5월 10일 | 2층 로비

EPMR을 활용한 의료기기 관리효율 향상을 위한 고찰

서현원[1], 안호문[1], 김원규[1], 이호석[1], 김태종[1], 임효순[1], 권혁남[1], 김병태[1,2]
[1]삼성서울병원 의공학과, [2]성균관대학교 의과대학

A study on the EPMR for efficiency improvement of medical device management

H.W. Seo[1], H.M. Ahn[1], W.K. Kim[1], H.S. Lee[1], T.J. Kim[1], H.S. Lim[1], H.N. Kwon[1] and B.T. Kim[1,2]
[1]Dept. of Medical Engineering, Samsung Medical Center, [2]Sungkyunkwan University School of Medicine

Abstract

The medical devices together with development of medical science are tending to transform diversified and complicated. Accordingly, Samsung Medical Center(SMC) has constructed the Samsung Medical Information System(SMIS) and utilized that system for the systematic management of medical treatment recording and medical device management. Especially, medical device management has groped the efficient management as integrating the computer maintenance management system(CMMS) continuously. Therefore, medical device and that all items are managed systematic. However, the completed CMMS is not constructed yet in the partial management, for example Preventive Maintenance activity.

This paper examines about the efficient management of medical device through the electric preventive maintenance record(EPMR) with the integrating laptop computer which have function of wireless LAN connection in PM activities

P2-43 | p486-p487 | 5월 10일 | 2층 로비

FET 바이오센서 개발을 위한 CuPc Field-effect Transistor의 전기적 특성

이호식, 박용필
동신대학교 병원의료공학과

Electrical Properties of CuPc Field-effect Transistor for Development of FET Biosensors

H. S. Lee, Y. P. Park
Dept. of Hospital and Biomedical Engineering, Dongshin University

Abstract

Organic field-effect transistors (OFETs) are of interest for use in widely area electronic applications. We fabricated a copper phthalocyanine (CuPc) based field-effect transistor with different metal electrode. The CuPc FET device was made a top-contact type and the substrate temperature was room temperature. The source and drain electrodes were used an Au and Al materials. The CuPc thickness was 40nm, and the channel length was 50㎛, channel width was 3mm. We observed a typical current-voltage (I-V) characteristics in CuPc FET with different electrode materials.

P2-44 | p488-p490 | 5월 10일 | 2층 로비

Loadcell을 이용한 악력 측정 시스템 구현

이성호, 유현준, 고화영, 강한수, 정성택
한국산업기술대학교 컴퓨터공학과

Implementation of Hand Grip Strength System using Loadcell

S.H. Lee, H.J. Yoo, H.Y. Ko, H.S. Kang, S.T. Chung
Dept. of Computer Engineering, Korea Polytechnic Univ.

Abstract

In this study, we developed a hand grip strength system using loadcell for measurement and analysis of muscular strength or aging accuracy. Also, the software designed in this study can be displayed effectively and saved to database for a transferred data by USB interface. We measured handgrip strength for thirty-eight weight-stable subjects (27 men, 11 women) aged 20-29. The experimental result are 342N/203N with left hand and 402N/220N with right hand in case of men and women, respectively.

P2-45 | p491-p494 | 5월 10일 | 2층 로비

PC 기반의 순음 청력 자가 측정 기법 개발

조현준[1,2], 권세윤[1], 김희평[1], 지윤상[1], 김영수[3], 김인영[1], 김선일[1]
[1]한양대학교 의과대학 의공학교실, [2]한양대학교 전기제어생체공학부, [3]한양대학교 의과대학 신경외과

Development of the PC based Self-test Puretone Audiometer

H. J. Cho[1,2], S. Y. Kwon[1], H. P. Kim[1], Y. S. Ji[1], Y. S. Kim[3], I. Y. Kim[1], S. I. Kim[1]
[1]Department of Biomedical Engineering, College of Medicine, Hanyang University, Seoul, Korea
[2]Department of Electric & Control Biomedical Engineering, Hanyang University, Seoul, Korea
[3]Department of Neurosurgery, College of Medicine, Hanyang University, Seoul, Korea

Abstract

A pure-tone audiometry allows a ENT doctor to determine how well the hearing functions of person who hearing impaired and normal as well. However, there are uncomfortable and money cost problems for hearing patients because they should have to visit a hospital every time for simple examination. In this study, we proposed and developed a pc-based self-audiometry technique and module. All of the puretone stimuli and the audiometry GUI (Graphic User Interface) for this experiments were generate using by MatLAB 7.0. Results from the four subjects(3 males and 1 female, age 22~28 years) test, there is significant correlation between the pc-based self-audiometry thresholds and the investigator-based audiometry. From the results, self-audiometry technique is possible to measure hearing threshold reliably in normal hearing person, and moreover, we will extend this study for hearing impaired and going to develope a PDA based self-auidiometry module.

P2-46 | p495-p500 | 5월 10일 | 2층 로비

뇌 신호원의 시계열 추출 및 인과성 분석에 있어서 ICA 기반 접근법과 MUSIC 기반 접근법의 성능 비교 및 문제점 진단

정영진, 이진영, 이정희, 임창환
연세대학교 의공학부

Comparison of ICA-based and MUSIC-based Approaches Used for the Extraction of Source Time Series and Causality Analysis

Y. J. Jung, J. Y. Kim, J. H. Lee, C. H. Im
Department of Biomedical Engineering, Yonsei University

Abstract

Recently, causality analysis of source time series extracted from EEG or MEG signals is becoming of great importance in human brain mapping studies and noninvasive diagnosis of various brain diseases. Two approaches have been widely used for the analyses: one is independent component analysis (ICA), and the other is multiple signal classification (MUSIC). To the best of our knowledge, however, any detailed comparison studies to reveal the difference of the two approaches have not been reported. In the present study, we compared the performance of the two different techniques, ICA and MUSIC, especially focusing on how accurately they can estimate and separate various (linear, nonlinear, and chaotic) brain electrical signals without a priori knowledge. Results of realistic simulation studies, adopting directed transfer function (DTF) and Granger causality (GC) as measures of the accurate reconstruction, demonstrated that the MUSIC-based approaches are even more reliable and more useful than the ICA-based approaches.

P2-47 | p501-p504 | 5월 10일 | 2층 로비

멀티 스케일 엔트로피를 이용한 정상인과 간질환자 뇌파의 복잡도 정량화

신병철[1], 송인호[1], 이종실[1], 지영준[1], 김영수[2], 김인영[1], 김선일[1]
[1]한양대학교 의용생체공학과, [2]한양대학교 의과대학 신경외과

Multiscale Entropy Analysis of Healthy Volunteers and Epilepsy Patients Complexity Quantify of EEG

B. C. Shin[1], I. H. Song[1], J. S. Lee[1], Y. J. Chee[1], Y. S. Kim[2], S. I. Kim[1], I. Y. Kim[1]
[1]Department of Biomedical Engineering, College of Medicine, Hanyang University
[2]Department of Neurosurgery, College of Medicine, Hanyang University

Abstract

The goal of this study is demonstrates the complexity of extracranial and intracranial EEG recording from normal and epilepsy patients by using MSE (Multiscale entropy Analysis) method.Five healthy volunteers and five epilepsy patients participated for this study. Group A was recording from the surface in an awake state with eyes closed, Group B was recorded from the epileptogenic zone during seizure free intervals, and Group C was recorded from epilepsy patients with during seizure. Each SampEn value of healthy volunteers and epilepsy patients was increased scale 1-5 and convergence to 1.3 scale 6-20 in case of Group A. increased scale 1-11, and convergence to 1.7 scale 12 in case of Group B. rapidly increased scale 1-7 and convergence to 1.3 scale 8 in case of Group C. Group A and Group C lower complexity because of repetition regularity, however Group B higher complexity because of irregular signals. In this study, divide the complexity from the state of EEG by using the MSE and demonstrates that MSE is a good method to analyze the complexity.

P2-48 | p505-p508 | 5월 10일 | 2층 로비

서파 차단을 통한 변성망막 마우스의 전기자극 최적화

예장희, 구용숙
충북대학교 의과대학 생리학교실

Optimization of Electrical Stimulation in Degenerate Mouse Retina by Blocking Slow Wave Component

J. H. Ye and Y. S. Goo
Department of Physiology, Chungbuk National University Medical School

Abstract

Retinal prosthesis is regarded as the most promising method for restoring vision for the blind with retinal diseases such as retinitis pigmentosa (RP) and age related macular degeneration (ARMD). Among the several prerequisites for retinal prosthesis to succeed, one of the most important is the optimization of electrical stimuli applied through the prosthesis. For RP model, *rd/rd* mice were used for this study. About 10 Hz slow wave component originated from glutamatergic synapse appeared with few ganglion cell spikes in *rd/rd* mice retina. Therefore, we blocked the slow wave component with specific glutamatergic synapse blocker, and compared the differences in evoked response before and after the drug treatment. 20 trains of charge-balanced biphasic, anodic-first square wave current pulse with no interphase delay were randomly applied at the rate of 0.25 Hz. The stimulations were delivered via one channel of 60 channels of 8 × 8 Multi-electrode array (MEA), and ganglion cell activities were recorded with the remaining 59 channels. Evoked ganglion cell responses were counted during a 1 ~ 25 ms time span after the stimulation. There are two electrically evoked responses, the very early response and early response. The very early response was defined as the response of 1~3 ms latency, and the early response, 10 ms latency. The amplitude of the very early response was significantly increased with the application of CNQX and AP7 (68.9 + 2.7 μV vs 246.3 + 28.5 μV(n=3), $p<0.01$), while that of early response was not changed ($p=0.16$). The strength-duration curve was almost same both in before and after the CNQX and AP7 treatment. More experiment with CNQX and AP7 is needed to answer the question if the presence of slow wave component is a major obstacle in providing electrical stimulation through prosthesis in degenerate retina.

P2-49 | p509-p512 | 5월 10일 | 2층 로비

인공와우의 어음처리기법에 적용하기 위한 힐버트 변환과 energy operator의 비교

최성진, 김경환
연세대학교 보건과학대학 의공학과

A comparison of the Hilbert transform and the energy operator approach to the speech processor of cochlear implants

S. J. Choi, K. H. Kim
Department of Biomedical Engineering, College of Health Science, Yonsei University

Abstract

Present cochlear implants have only used the envelope information for the generation of electrical stimulus pulse. Several researcher tried to apply fine structure into existing cochlear implant, according to fine structure plays an important roll in pitch perception, speaker identification and music perception. They used Hilbert transform for the extraction of fine structure. We proposed the utilization of energy operator for the extraction of fine structure. Energy operator is faster than Hilbert transform and it has similar performance. We compared Hilbert transform and energy operator to show energy operator is more suitable for the application to the speech processor of cochlear implants. In this paper, we compared the performance for the extraction of instantaneous frequency and measured the computation time of each strategy. As a result, energy operator showed the equivalent performance and it is faster than Hilbert transform.

P2-50 | p513-p516 | 5월 10일 | 2층 로비

작업난이도에 따른 시각 oddball 작업 수행 시 위상 동조 분석

윤진, 김자현, 김경환
연세대학교 보건과학대학 의공학과

Phase synchrony analysis of the visual oddball paradigms in difficulty levels

J. Yoon, J. H. Kim, K. H. Kim
Department of Biomedical Engineering, College of Health Science, Yonsei University

Abstract

본 연구는 작업난이도에 따른 시각 oddball 실험에 대한 뇌전도(electroencephalogram, EEG)를 측정하여 작업 난이도에 따라 사상관련전위(event related potential, ERP)중 P300요소의 변화를 관찰하고 대뇌 영역들 간의 위상 동조 분석을 통해 시-공간 기능적 연결성을 확인하는 것을 목적으로 한다.

정상인 17명을 대상으로 난이도를 달리한 시각 oddball 실험을 수행하였다. 자극 시점을 기준으로 앙상블 평균에 의한 사상관련전위(event related potential, ERP)를 관찰하고 작업난이도에 따른 P300요소의 크기를 통계적으로 관찰하여 작업난이도에 따라 크기가 다름을 관찰 하였다.

Surrogate data를 이용하여 신호 자체 특성잡음에 독립적이면서 자극 전보다 증가된 감마 위상 동조(induced gamma phase synchrony)를 관찰하기 위해 두 개의 기준 값을 두었다. 이 기준 값을 동시에 만족시키는 위상고정 값(phase locking value, PLV)을 17개 전극 쌍에 대해 계산하여 작업난이도에 따른 시-공간적 위상 동조 분석을 수행 하였다.

P2-51 | p517-p520 | 5월 10일 | 2층 로비

정상망막과 변성망막의 전기자극 파라미터 비교

예장희, 구용숙
충북대학교 의과대학 생리학교실

Comparison of Electrical Stimulation Parameters for Normal and Degenerate Retina

J. H. Ye and Y. S. Goo
Department of Physiology, Chungbuk National University Medical School

Abstract

Retinal prosthesis is regarded as a promising method for restoring vision for the blind with retinal diseases such as retinitis pigmentosa (RP) and age related macular degeneration (ARMD). Among the several prerequisites for retinal prosthesis to succeed, one of the most pressing is the optimization of electrical stimuli applied through the prosthesis. The electrical characteristics of diseased retina are expected to be different with those of normal retina. Therefore, we investigated different electrical stimulation parameters to evoke a ganglion cell response in normal and degenerate retina. The retinal degeneration model (*rd/rd* mouse) was compared against control mice. Current stimulations were delivered via one channel of 60 channels 8 × 8 Multielectrode array (MEA), and ganglion cell activities were recorded with the remaining 58 channels. The parameters of electrical stimulation were set based on previous experiment with rabbit. Evoked responses were counted during a 1 ~ 25 ms time span after the stimulation. 20 trains of charge-balanced biphasic, anodic-first square wave current pulse with no interphase delay were randomly applied at the rate of 0.25 Hz. There are two electrically evoked responses, the very early response and early response. The very early response was defined as the response of 1 ~ 3 ms latency, and the early response, ~5 ms latency. In *rd/rd* mouse retina, the amplitude of the very early and early was 68.9 ± 2.7 μV and 21.1 ± 10.8 μV, respectively. While in normal retina, the amplitude of very early and early was 23.87 ± 2.60 μV and 11.39 ± 3.37 μV, respectively.

Further study is necessary to have concrete stimulation parameters for normal and *rd/rd* mice retina.

P2-52 | p521-p523 | 5월 10일 | 2층 로비

개인의 효율적인 건강관리를 위한 헬스인덱스의 개발

양용주, 문동주, 이성일
한국생산기술연구원 로봇기술본부 제어·인식팀

Development of the Health Index that can be efficiently managed personal health using the bio-signals

Y. J. Yang, D. J. Moon, S. I. Yi
Control & Perception Research Team, Division for Applied Robot Technology, Korea Institute of Industrial Technology (KITECH)

Abstract

The interest in healthy and happy life for seniors has been increased recently as the quality of life in old age becomes a hot issue.

We have developed the health index that can be efficiently managed for personal health using the bio-signals such as heart rate, blood pressure, body fat and temperature. It also consisted of basic information, measured information and questionnaires.

Basic informations are height, weight, age, sex. Measured informations are the recorded bio signals from the user using instruments. Finally, questionnaires include informations about the cardiac & vascular, stress, management and obesity. The health index we are developing can analyze the health information of the user, explain the health state of the user easily.

P2-53 | p524-p526 | 5월 10일 | 2층 로비

골프 퍼팅 동작의 일관성 판단에 관한 연구

이성대[1], 김형식[1], 최진승[1], 강동원[1], 임영태[2], 탁계래[1], 이정한[1]
[1]건국대학교 의료생명대학 의학공학과, [2]건국대학교 스포츠과학부 골프지도학과

A Study on the Consistency Estimation During Golf Putting Stroke

S. D. Lee[1], H. S. Kim[1], J. S. Choi[1], D. W. Kang[1], 1Y. T. Lim[2], G. R. Tack[1] and J. H. Yi[1]
[1]Biomedical Engineering, College of Biomedical & Life Science, Konkuk University
[2]Division of Sports Science, Golf Teaching Major, Konkuk University

Abstract

In this paper, we identified the consistency between elite and novice golfers using clustering algorithm. The kinematic parameters such as head, elbow, pelvis and knee were measured by 3D motion analysis system(Motion Analysis Co, USA) as well as grip force was measured by smart putter system at a time. The clustered data was represented by a dendrogram and transform- ed it to numerical average values. The results shows that the elite golfers for kinematic and grip force has more consistency than novice golfers.

P2-54 | p527-p530 | 5월 10일 | 2층 로비

뇌간기능 평가를 위한 Mayer wave에 대한 예비 연구

백현재[1], 김정수[1], 김고근[1], 안원식[2], 김동욱[3], 박광석[4]
[1]서울대학교 협동과정 바이오엔지니어링, [2]서울대학교병원 마취통증의학과, [3]성균관대학교 통계학과, [4]서울대학교 의과대학 의공학과

A Preliminary Study of Mayer wave for Evaluation of Brainstem Function

H.J.Baek[1], J.S.Kim[1], K.K.Kim[1], W.S.Ahn[2], D.W.Kim[3] and K.S.Park[4]
[1]Interdisciplinary Program of Bioengineering, Seoul National University,
[2]Dept.of Anesthesiology and Pain Medicine, Seoul National University Hospital,
[3]Dept.of Statistics, Sungkyunkwan University,
[4]Dept. of Biomedical Engineering, College of Medicine, Seoul National University

Abstract

Mayer wave is rhythmical variation with a frequency varying from 6 to 10 cycles a minutes. In this paper, we proposed that mayer wave could be measured from photoplethymographic DC signal. There were many studies about mayer wave but still have considerable controversy with regard to the origin of mayer wave. From our preliminary analysis, mayer wave may be related with brainstem function and it can be applied to early brain death determination. Using cost effective PPG technique, early brain death diagnosis system can be made in the future.

P2-55 | p531-p533 | 5월 10일 | 2층 로비

미세유체 칩을 이용한 전기화학적 면역진단 센서 제작

유성주[1,2], 최영봉[2], 주종일[1], 김혁한[2], 이상훈[1]
[1]고려대학교 보건과학대학 생체의공학과, [2]단국대학교 첨단과학대학 화학과

Fabrication of electrochemical immunosensor using a microfluidic Chip

S. J. Yoo[1,2], Y. B. Choi[2], J. I. Ju[1], H. H. Kim[2], S. H. Lee[1]
[1]Dept. of Biomedical Eng. Korea University, [2]Dept. of Chemistry. Dankook University

Abstract

This paper presented a novel process for qualitative analysis of Rabbit-IgG and microfluidics chip system using electrochemical immunoassay technology. The dam post prevent to slip out of the anti-rabbit-IgG immobilized on the polybead surface in channel. And then this anti-rabbit-IgG in the channel was performed an antigen-antibody reaction when the rabbit-IgG was injected in the channel. We could be performed the qualitative analysis about rabbit-lgG by using a competitive reaction of rabbit-lgG and rabbit-lgG-Fc. Actually, rabbit-lgG-Fc was synthesized the electrochemical activity conditioned-Ferrocene and rabbit-lgG.

P2-56 | p534-p535 | 5월 10일 | 2층 로비

복강경 수술로봇의 원격 제어

박준우[1], 최재순[2], 이덕희[1], 임영빈[1], 조영호[1]
[1]국립암센터 연구소 의공학연구과, [2]고려대학교 한국인공장기센터

Telecontrol for a Laparoscopic Surgical Robot

J.W. Park[1], J. Choi[2], D.H. Lee[1], Y.B. Im[1], Y.H. Jo[1]
[1]Biomedical Engineering Branch, Research Institute, National Cancer Center,
[2]Korea Artificial Organ Center, College of Medicine, Korea University

Abstract

We developed a force feedback controller for a laparoscopic surgical robot without using additional torque sensors. Force feedback controller was implemented using position error based, bilateral control algorithm. The command for the slave is based on the master position. The reference for the master is based on the estimated torque between the slave and the environment. To compute the slave torque without a torque sensor, we made a contact model between the slave and the external environment. We controlled the master using the current control method with the current command proportional to the estimated slave torque. In preliminary results, the developed force feedback algorithm implemented on the grip axis of the Laparobot showed acceptable performance.

P2-57 | p536-p539 | 5월 10일 | 2층 로비

BPN 알고리즘을 이용한 얼굴 인식 시스템

서광욱, 민병로, 김동우, 홍준택, 이민영, 정현웅, 최동석, 화윤일, 이대원
성균관대학교 생명공학부 바이오메카트로닉스학과

Face Recognition System using Back Propagation Algorithm Network

K.W. Seo, B.R. Min, D.W. Kim, J.T. Hong, M.Y. Lee, H.W. Jung, D.S. Choi, Y.I. Hwa, D.W. Lee
Department of Biomechatronic Engineering, Sungkyunkwan University

Abstract

In these days, application of face recognition is increasing because of necessity for protection of individual information. Face recognition system use pattern of face, but an individual's expression is various, it is more difficult method than any other recognition method. This means, face recognition method needs highly cognitive faculty. This face recognition system using single 1/3" CCD camera and single light source is proposed. And received image data is studied by BP(back propagation) algorithm. The data which is studied by BP algorithm is compared with experimental data.

In this research, the proposed system can recognize individual face in limited environment which optimize light source and face expression. Despite of simple composition and algorithm, this system can obtain highly rate of recognition (average : 78.54%, maximum : 93.33%).

P2-58 | p540-p541 | 5월 10일 | 2층 로비

초음파 영상용 플라스틱 기반의 phantom제작 및 특성 분석

이균정, 박동희, 신태민, 서종범
연세대학교 보건과학대학 의공학과

Analyze properties and design phantom based on plastic hardener and softener for ultrasonic imaging

G. J. Lee, D. H. Park, T. M. Shin, J. B. Seo
Department of Biomedical Engineering, Yonsei University

Abstract

Plastic hardener and softener based ultrasound phantoms were made in various constitutions and their acoustic properties were measured. Speed of sound is approximately 1.4 mm/μsec in all the phantoms, which is about 7% less than that of in soft tissue. Attenuation coefficient is strongly dependent on the ratio between hardener and softener. In order to achieve the tissue level attenuation (0.5 dB/cm/MHz), 60% of hardener or less is required. The synthesized phantoms can be preserved for more than 6 months without structural degradation.

구연논문 Ⅲ

심혈관계, 의료기기

좌장 | 이태수(충북대), 최병철(춘해대)

O3-1 | p542-p544 | 5월 10일 | 1층 회의실

대동맥 경화도 측정법에 대한 고찰

서지혜[1], 최동호[1], 오수경[1], Rainer Rienmueller[2], 이종민[1,3]
[1]경북대학교 대학원 의용생체공학과, [2]Univ.-Klinik f. Radiologie, [3]경북대학교 의과대학 영상의학과

A Consideration for Aortic Wall Stiffness Evaluation Technique

Jeehye Seo[1], Dongho Choi[1], Zhuqing Wu[1], Rainer Rienmueller[2], Jongmin Lee[1,3]
[1]Department of Biomedical Engineering, Kyungpook National University,
[2]Univ.-Klinik f. Radiologie, LKH-Universitaetskliniken GRAZ, Graz, Austria,
[3]Diagnostic Radiology, School of Medicine, Kyungpook National University

Abstract

The aim of this study is to evaluate aortic wall stiffness without influence of different background blood pressure. We developed a new technique for evaluating aortic wall stiffness, the aortic distensibility index(ADI). Based on age, the ADI has better correlation than other indexes. In conclusion, ADI, the method to evaluate aortic wall stiffness free from variable blood pressure and aortic size, was verified with significant practical feasibility.

O3-2 | p545-p548 | 5월 10일 | 1층 회의실

고차 통계와 Hermite Basis 함수를 이용한 SVM 기반 심박동 분류

박관수[1], 조백환[1], 이도훈[1], 송수화[1], 이종실[1], 지영준[1], 김영수[2], 김인영[1], 김선일[1]
[1]한양대학교 의용생체공학과, [2]한양대학교 의과대학 신경외과

Support Vector Machine Based Heartbeat Classification Using Higher Order Statistics and Hermite Basis Function

K. S. Park[1], B. H, Cho[1], D. H. Lee[1], S. H. Song[1], J. S. Lee[1], Y. J. Chee[1], Y. S. Kim[2], I. Y. Kim[1], S. I. Kim[1]
[1]Department of Biomedical Engineering, Hanyang University
[2]Department of Neurosurgery, College of Medicine, Hanyang University

Abstract

This paper presents a new solution to the system for reliable heartbeat recognition. The recognition system uses the support vector machine(SVM) working in the classification mode. Two different preprocessing methods for generation of features are applied. One method involves the higher order statistics(HOS) while the second the Hermite characterization of QRS complex of the electrocardiogram(ECG) waveform . Some of the results of the recognition of 4 heartbeat types on the basis of ECG waveforms are good enough to evaluate classifier performance for N and V class.

O3-3 | p549-p552 | 5월 10일 | 1층 회의실

휴대형 무선 3채널 심전계의 성능 평가

홍주현, 차은종, 이태수
충북대학교 의과대학 의공학교실

Evaluation of Wireless 3 Channel Portable ECG Recorder

J. H. Hong, E. J. Cha, T. S. Lee
Department of Biomedical Engineering, College of Medicine, Chungbuk National University

Abstract

In this study, four experiments were performed to evaluate the accuracy, reliability and operability, applicability during daily life, and fall detection functionality of the developed device. First, ECG signals were measured using the developed device and Biopac device(reference device) during sitting and marking time and compared to verify the accuracy of R-R intervals. Second, the reliable data transmission to remote server was verified on two types of simulated emergency event using patient simulator. Third, during daily life with five types of motion, accuracy of data transmission to remote server was verified on two types of event occurring. Last, device wearer's fall detection functionality was tested using accelerometer of the developed device. By acquiring and comparing subject's biomedical signal and motion signal, the accuracy, reliability and operability, applicability during daily life, fall detection functionality of the developed device were verified. In addition, PDA-phone based wireless system can monitor patient without any constraints.

O3-4 | p553-p554 | 5월 10일 | 1층 회의실

바이오센서용 착용형 전류계측 시스템

강구태[1], 정동근[1], 심윤보[2]
[1]동아대학교 의과대학 의공학교실, [2]부산대학교 화학과

In Vivo Wearable Amperometry System for Biosensors

G. T. Kang[1], D. K. Jung[1], Y. B. Shim[2]
[1]Department of Medical Engineering, College of Medicine, Dong-A University,
[2]Department of Chemistry, Pusan National University

Abstract

In this paper, we present the development of wearable amperometer for biosensors adapted in experimental animal such as rat. The system was consist of amperometer, potentiometer, microcontroller, Bluetooth module. All data measured from the subject were transmitted to personal computer (PC) by Bluetooth communication. In order to increase the operating time of the device without any disruption, we used scheduled operation of the system. The measuring system was small enough to set on the back of the rat. Signals from the biosensors attached to the rat could be monitored in PC in wireless mode using this system.

O3-5 | p555-p558 | 5월 10일 | 1층 회의실

최소 침습 수술 로봇을 위한 관절형 Instrument 개발

이민영, 민병로, 김동우, 서광욱, 홍준택, 정현웅, 최동석, 화윤일, 이대원
성균관대학교 생명공학부 생명공학과

Development of an Articulated Instrument for a Minimally Invasive Surgery Robot

M. Y. Lee, B. R. Min, D. W. Kim, K. W. Seo, J. T. Hong, H. W. Jung, D. S. Choi, Y. I. Hwa, D. W. Lee
Department of Biotechnology and Bioengineering,
Devision of Biotechnology and Bioengineering, SungKyunKwan University

Abstract

There are many advantages in laparoscopy surgery than laparotomy. But, Instrumental movements are restricted in laparoscopy. Robot surgery is widely used to overcome these drawbacks. However, Surgery robots are so expensive that cannot be using widely.

So, in this paper, we developed an instrument to be controlled freely for surgery to solve a disadvantage and upgrade existing laparoscopy. We have been designed and made an instrument. It has three joints which are able to rotate at -90° to 90°. By this, surgeons can overcome restricted working which is one of disadvantages of existing laparoscopic instruments.

구연논문 Ⅳ

의공학신기술, 신경공학, 재활공학

좌장 | 탁계래(건국대), 김경환(연세대)

O4-1 | p559-p562 | 5월 10일 | 2층 세미나실

생체 삽입형 SU-8 마이크로전극의 제작과 Neural Interface를 위한 평가

이대호[1], 백주열[2], 백동현[3], 이은중[4], 최지현[5], 이민아[5], 이상훈[1]
[1]고려대학교 보건과학대학 생체의공학과, [2]연세대학교 보건과학대학 의공학부,
[3]고려대학교 전기전자공학과, [4]고려대학교 의료정보기기학과, [5]한국과학기술연구소(KIST)

Fabrication of Depth-type SU-8 microelectrodes and Evaluation for Neural Interface

D.H. Lee[1], J.Y. Baek[2], D.H. Baek[3], E.J. Lee[4], J.H. Choi[4], M.A. Lee[5], S.H. Lee[1]
[1]Dept. of Biomedical Eng. Korea University, [2]Dept. of Biomedical Eng. Yonsei University,
[3]Dept. of Electrical Eng. Korea University, [4]Dept. of Medical Electronics and Information Eng. Korea University,
[5]Korea Institute of Science and Technology(KIST)

Abstract

This paper reports a simple and easy-to-fabricate implantable electrode using SU-8 as a substrate material. SU-8 is a photosensitive epoxy resin, which, due to a low optical absorption in the near-UV region, allows good aspect ratio structures to be obtained. Moreover, this material has a lower modulus than silicon and polyimide (Young's modulus: ~ 3.2 GPa) and good electrical properties and biocompatibility. In addition, a thick structure (> 100 μm) can be created using a one-time spin-coating procedure. Usually, to separate the microstructures from the substrate, the back etching of silicon wafer for long time is required, which requires additional time, labors and monetary cost. Long term exposure of electrode to toxic chemicals may cause negative effects when implanted in the body. Here, we simplified the separation process by using the commercially available polyimide film as substrate material. On the Kapton film, we have fabricated the SU-8 electrode and the detachment of electrode from the film was done. The fabricated SU-8 electrode was evaluated through the following two tests to confirm the feasibility as implantable electrode for BMI: (1) insertion and biocompatibility of SU-8 electrode by implanting at rat cortex and (2) recording neural signals.

O4-2 | p563-p566 | 5월 10일 | 2층 세미나실

인공망막의 최적자극조건을 찾기 위한 전기자극세기 변조를 통한 망막신경절세포의 발화율 변화 관찰

류상백[1], 김경환[1], 예장희[2], 구용숙[2]
[1]연세대학교 보건과학대학 의공학과, [2]충북대학교 의과대학 생리학 교실

Modulation of firing rates of rabbit RGCs by controlling stimulation pulse intensity for optimal stimulation of artificial retina

S. B. Ryu[1], K. H. Kim[1], J. H. Ye[2] and Y. S. Goo[2]
[1]Department of Biomedical Engineering, College of Health Science,
Yonsei Medical Engineering Institute, Yonsei University
[2]Department of Physiology, Chungbuk National University Medical School

Abstract

Artificial retina (visual prosthesis) is a device which is designed to restore visual function of blind patients by stimulating intact retinal ganglion cells (RGC). In order to deliver visual information successfully with artificial retina, it is necessary to understand responses of RGCs to electrical stimulation. As a first step to find one of the optimal parameters of electrical stimulation, we observed changes of firing rates of rabbit RGCs under various electrical (current) pulse intensities. As a result, we could decide intensity modulation range which can partly control firing rates of RGCs. And, we were also able to estimate pulse intensity variations from the firing rates of RGCs with using spike train decoding algorithm and observed that how stimulatation rate affects information encoding of RGCs.

O4-3 | p567-p569 | 5월 10일 | 2층 세미나실

인지과제의 종류에 따른 보행 패턴의 변화에 대한 연구

최진승, 강동원, 정순철, 탁계래
건국대학교 의학공학부

Changes of walking pattern by types of cognitive task

J. S. Choi, D. W. Kang, S. C. Chung, G. R. Tack
Department of Biomedical Engineering, Konkuk University

Abstract

The purpose of present study was to identify effects of types of cognitive tasks on walking pattern during treadmill walking. Experiments consisted of 3 conditions: (1) treadmill walking alone (control phase), (2) 2-back task with/without treadmill walking, (3) Stroop test with/without treadmill walking. All experiments were performed with preferred walking speed for 10 minutes. To compare with each condition, temporal and spatial variables were calculated from acquired data using motion capture system. CV (coefficient of variance) and DFA (detrended fluctuation analysis) were used to compare effects as types of cognitive task. As results of CV, step length and step width variability were significantly different. At DFA, step time variability was significantly different. Further study is necessary to clarify this result.

O4-4 | p570-p573 | 5월 10일 | 2층 세미나실

The Effect of Vibratory Stimuli on Supporting Leg during One-Legged Standing in the Elderly

유미[1], 박용군[1], 김동욱[2], 김용욱[3], 권대규[2,4], 김남균[2]
[1]전북대학교 의용생체공학과, [2]전북대학교 바이오메디컬공학부,
[3]전북대학교 헬스케어기술개발사업단, [4]전북대학교 실버공학연구센터

The Effect of Vibratory Stimuli on Supporting Leg during One-Legged Standing in the Elderly

Mi Yu[1], Yong-Jun Piao[1], Dong Wook Kim[2], Yong Yook Kim[3], Tae Kyu Kwon[2,4] and Nam Gyun Kim[2]
[1]Dept. of Biomedical Engineering, Chonbuk National Univ.
[2]Division of Biomedical Engineering, Chonbuk National Univ.
[3]Center for the Healthcare Technology Development, Chonbuk National Univ.
[4]Bioengineering Research Center for the Aged, Chonbuk National Univ.

Abstract

The purpose of this study was to analyze the effects of vibratory stimuli on tibialis anterior and Achilles tendon of supporting leg during one-legged standing in the elderly. The sway of the center of pressure(COP) and plantar pressure was observed on supporting leg during one-legged standing by 20 healthy elderly with and without vibratory stimulation to the tibialis anterior and the Achilles tendon. The results was found that the peak pressure of the region of the first metatarsal head and the great toe had maximum values that were significantly greater than those of the other regions during one-legged standing with vibratory stimulation on supporting leg. The sway of COP was significantly less with vibratory stimulation on supporting leg during one-legged standing. These findings are important for the use of somatosensory information toward the development of rehabilitation system for balance.

O4-5 | p574-p577 | 5월 10일 | 2층 세미나실

척추 측만이 족저압 분포에 미치는 영향에 관한 연구

박재현, 노시철, 장화선, 최흥호
인제대학교 의생명공학대학 의용공학과

The Study for Effects that Scoliosis Influence on Foot-Pressure Distribution

J. H. Park, S. C. Noh, H. S. Jang, H. H. Choi
Dept. of Biomedical Engineering, College of Bioscience Engineering, Inje University

Abstract

In this study, analysis for effects that scoliosis influence on foot-pressure distribution executed to males who are twenties and have no clinical history of vertebral disease. The F-scan system(850Hz sampling frequency) was used for the measuring foot pressure. The sole is divided into 7 regions of interest(ROI). The scoliosis was expressed an angle using vertebral X-ray image of subjects. An angle used evaluating correlation with the scoliosis and the foot-pressure distribution. The measuring was executed by using same protocol to all subjects. The scoliosis and the transmitted foot-pressure distribution's difference to the sole was proportionate. The variables used for analysis were showed high correlation under the 0.05 level of significance. This study is considered to distinguish vertebral and lower limbs disease, and expected to qualitative evaluation basis to rehabilitation patients with lower limbs disease.