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

◎ 한양대학교 조직위원회 임원 ◎

▶ **준비위원장 :** 이종민

▶ **준 비 위 원 :** 김인영, 김선정, 김영수, 남상원, 지영준, 이종실, 송인호

속표지

2008년도 대한의용생체공학회 추계학술대회 프로그램

1. 추계학술대회 일정 및 장소

｜일 정｜ 2008년 11월 14일(금요일)

｜장 소｜ 한양대학교 한양종합기술원(HIT) 1층, 6층

｜학회주제｜ 혈압측정 방법에 관한 의학적 공학적 고찰

2. 세부 일정 개요

11월 14일 (금)				
시간 / 장소	6층 대회의실 (612호)	A (606호)	B (608호)	1층 로비
09:00 ~	등 록			
09:30 ~ 12:50	Tutorial (혈압측정법)	지식경제부 평가발표회 (총괄)	평의원회	포스터 I
12:50 ~ 14:00	점 심			
14:00 ~ 16:00	개회식 및 특강			포스터 II
16:00 ~ 16:30	정기총회		학생논문경연 (15:00 시작)	
15:00 ~ 18:00				
18:30 ~	만 찬			

11월 14일 (금)

• Tutorial : 혈압측정법 (사회 : 안원식)
 – 세 가지 혈압 측정법의 측정 대상과 방법 / 안원식 (서울대병원 의료기기 임상평가실장)
 – 비침습적 혈압 측정의 공학적 고찰 / 지영준 (한양대학교 의용생체공학과)
 – 비침습적 혈압 측정의 의학적 고찰 / 서광석 (서울대학교 치과마취통증의학과)
 – 침습적 혈압 측정의 공학적 고찰 / 최성욱 (강원대학교 기계의용공학과)
 – 침습적 혈압 측정의 의학적 고찰 / 박재현 (서울대학교 마취통증의학과)

• 특강 :
 – Publishing in Biomedical Engineering.
   Prof. Jos A.E. Spaan, MBEC Editior-in-Chief
 – Bioengineering, Translational Research & Technology commercialization
   Prof. Yongmin Kim (Department of Bioengineering, University of Washington)

• 포스터 I : 심혈관계, 의료기기, 의료정보, 신경공학, 의공학신기술
• 포스터 II : 의공기사, 의학영상/광학, 임상의공학, 미세/나노기술, 정형/재활공학, 조직공학/생체재료

※ 학회장소 : 한양대학교 한양종합기술원(HIT)
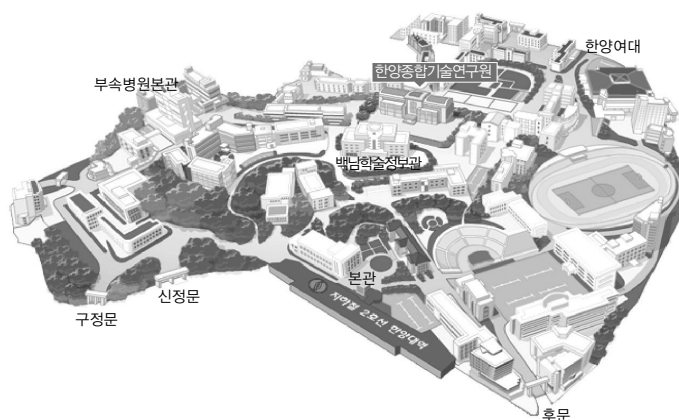
- **지하철로 오시는 길**

  지하철 2호선 '한양대' 역 2번 출구로 나오시면 바로 학교 정문을 찾으실 수 있습니다.

- **자동차로 오시는 길**

  강남 방면에서 : 성수대교 → 뚝섬 교차로 → 성동교 → 한양대학교

  잠실 방면에서 : 잠실대교 → 건국대학교 → 뚝섬 → 성동교 → 한양대학교

  종로 방면에서 : 신당동 → 왕십리 교차로 → 한양대학교

- **버스로 오시는 길**

  다음 버스를 타고 '한양대' 앞에서 내리십시오.

  간선 : 302, 410

  지선 : 2013, 2014, 2222, 2012

※ 참가비 납부방법

2008 추계	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 추계학술대회

Tutorial 주제 : 혈압 측정법

사회 : 안원식 (서울대병원 의료기기 임상평가실장)

특강

2008 지식경제부 전략기술개발사업 성과발표회

- 일시 : 2008년도 11월14일(금) 한양대학교 한양종합기술원(HIT) 6층 606호
- 구두발표 : 2008.11.14(금) - 09:30 ~ 18:00 (606호) 좌장 - 유선국(연세대학교)
- 포스터 및 연구결과 전시 : 2008.11.14(금) (6층)

□ 주관 : 한국산업기술평가원, 대한의용생체공학회
   이번 성과발표회는 현재 개발 수행 중인 과제의 정보공유를 통한 사업내실화, 전공분야 연구자들에 의한 연구성과 검증 등을 목적으로 하여, 총12개의 총괄과제는 구두발표로, 총괄과제에 관련된 세부과제는 전시부스에 포스터 및 성과물 발표를 통하여 이루어질 예정이다.

성과발표 과제

□ 총괄과제 : 첨단 고해상도 생체영상 진단기기 핵심 원천기술 및 응용기술 개발 - 오칠환(고려대학교) / 09:30~10:00 /

□ 총괄과제 : 고화질 입체 복강경 시스템 개발 - 김영우(국립암센터) / 10:00~10:30 /

□ 총괄과제 : 고령친화형 사상 체질기반 진단/치료기 개발 - 김종열(한국한의학연구원) / 10:30~11:00 /

□ 총괄과제 : 실버의료기기 핵심기술 개발 - 전경진(한국생산기술연구원) / 11:00~11:30 /

□ 총괄과제 : 차세대 분자영상 시스템 기술개발 - 조규성(한국과학기술원) / 11:30~12:00 /

□ 총괄과제 : 강력집속 초음파를 이용한 암치료 장비 - 윤형로(연세대학교) / 12:00~12:30 /

□ 총괄과제 : 차세대 바이오신호 융합 DxR 시스템 개발 - 박창원(한국전자의료산업재단) / 12:30~13:00 /

2008 지식경제부 전략기술개발사업 포스터/전시부스 섹션

- 일시 : 2008년도 11월 14일(금) 한양대학교 한양종합기술원(HIT) 6층
- 구두발표 : 2008.11.14(금) - 09:30 ~ 18:00 (606호)
- 포스터 및 연구결과 전시 : 2008.11.14(금) (6층 로비)

□ 주관 : 한국산업기술평가원, 대한의용생체공학회
　이번 성과발표회는 현재 개발 수행 중인 과제의 정보공유를 통한 사업내실화, 전공분야 연구자들에 의한 연구성과 검증 등을 목적으로 하여, 총12개의 총괄과제는 구두발표로, 총괄과제에 관련된 세부과제는 전시부스에 포스터 및 성과물 발표를 통하여 이루어질 예정이다.

포스터/전시부스 과제

□ 총괄과제 : 첨단 고해상도 생체영상 진단기기 핵심 원천기술 및 응용기술 개발 - 오칠환(고려대학교) / 6층
□ 세부과제 :
　3차원 X선 마모-전산화 단층촬영장치 개발 - 박정병((주)디알젬)
　다중 모달리티 의학영상처리 시스템 개발 - 신영길(서울대학교)
　자기공명영상용 고효율 상자성 리간드 개발 - 장용민(경북대학교)
　In-vivo 공초점 주사 현미경 기술 개발 - 권대갑(한국과학기술원)
□ 총괄과제 : 고화질 입체 복강경 시스템 개발 - 김영우(국립암센터) / 6층
□ 세부과제 :
　의료용 양안식 HD급 3D 디스플레이 및 입체영상 저장 및 전송시스템 개발 - 이성중((주)파버나인)
　복강경 Manipulator 및 위치 지능제어 시스템 개발 - 조영호(국립암센터)
　고화질 HD급 입체 복강경 및 입체영상 신호처리 기술 개발 - 이응화((주)썸텍)
□ 총괄과제 : 고령친화형 사상 체질기반 진단/치료기 개발 - 김종열(한국한의학연구원) /6층
□ 세부과제 :
　오감형 진단시스템 개발 - 박연규(한국표준과학연구원)
　침/뜸 융합형 치료기 개발 - 이경중(연세대학교 산학협력단)
　차세대 원격 맥진 시스템 개발 - 허영(한국전기연구원)
　지능형 한방 컨텐츠 개발 - 김종열(한국한의학연구원)
□ 총괄과제 : 실버의료기기 핵심기술 개발 - 전경진(한국생산기술연구원) / 6층
□ 세부과제 :
　실버용 지능형 무인 Bathing/Showering 시스템 개발 - 이영식((주)대화디에이치)
　복합형 노인 건강 모니터링 시스템 개발 - 강동주((주)바이오넷)
　노인 개인의 보행특성에 맞는 낙상방지 보행훈련기기의 개발 - 강곤(경희대학교산학협력단)
　노인 관절기능 복원기술 개발 - 김정성((주)코렌텍)
□ 총괄과제 : 차세대 분자영상 시스템 기술개발 - 조규성(한국과학기술원) / 6층
□ 세부과제 :
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　MR 호환 PET 시스템 개발 - 최용(성균관대학교산학협력단)
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□ 세부과제 :
　HIFU 시스템 개발 - 송태경(서강대학교)
　HIFU(High Intensity Ultrasound) 프로브 개발 - 임성민((주)휴먼스캔)
　생체 실험 및 HIFU 수술의 최적화 - 안영복((주)오스테오시스)
□ 총괄과제 : 차세대 바이오신호 융합 DxR 시스템 개발 - 박창원(한국전자의료산업재단) / 6층
□ 세부과제 :
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　공간/바이오 융합정보처리 DxP개발 - 문원규(에이스웨이브텍(주))
　MMIC기반 원격 바이오 레이더 센서 개발 - 이윤수((주)유비즈플러스)

Tutorial

tutorial 주제: 혈압 측정법 | 사회: 안원식 (서울대병원 의료기기 임상평가실장)

- 세 가지 혈압 측정법의 측정 대상과 방법
  안원식 (서울대병원 의료기기 임상평가실장)

- 비침습적 혈압 측정의 공학적 고찰
  지영준 (한양대학교 의용생체공학과)

- 비침습적 혈압 측정의 의학적 고찰
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- 침습적 혈압 측정의 공학적 고찰
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- 침습적 혈압 측정의 의학적 고찰
  박재현 (서울대학교 마취통증의학과)

세 가지 혈압 측정법과 측정값의 비교

안원식

서울대학교병원 의료기기 임상평가실장

<이 글은 2007년도 대한마취과학회지 제 52권 4호에 실린 내용(저자: 안원식)을 대한마취과학회 간행위원회의 허락을 받고 인용 기재하였음을 밝힙니다.>

여러 인체 활력 징후 중에서 혈압은 매우 유용한 항목이어서 환자를 판단하는데 가장 많이 사용된다. 그래서 의사들은 혈압을 자주 측정하고, 특히 환자의 활력 징후가 급격히 변화할 수 있는 마취 중 환자나 중환자실의 환자를 돌보는 것이 주 임무인 마취과 의사들은 혈압 측정을 누구보다도 많이 시행하고 있다. 잦은 측정이 필요하여, 자동 혈압(automatic noninvasive blood pressure, ANIBP) 측정법도 개발하였고, 신속하고 정확한 혈압을 얻기 위해 침습적이지만 지속적인 혈압(Invasive Blood Pressure, IBP) 측정법도 도입하게 되었다. 그런데, 이 측정법들이 서로 측정 대상이나 방법이 다른데도 불구하고, 그 차이를 명확히 기술한 글이 없어 이 글을 작성하게 되었다.

1) 측정 대상

대부분의 임상 의사들은 혈관 안에 있는 혈액의 순수 압력만 혈압을 결정하는 물리적 특성으로 생각하고 있다. 하지만, 혈관 속을 흐르는 혈액이 가지는 에너지는 3가지 종류가 있으므로 이를 좀 더 세밀히 살펴보자. 먼저 질량을 가지고 있으므로 위치 에너지(중력)가 있고, 둘째, 이 글의 대상인 압력 에너지가 있다. 압력 에너지는 부피를 가진 물체가 가진 압력으로 부피와 압력의 곱으로 계산 된다. 마지막으로 혈액이 혈관 속에서 이동하고 있으므로 운동 에너지가 있다.[1] 이를 식 (Bernoulli's equation)으로 나타내면 다음과 같다.

$$\text{혈액의 총 에너지} = \text{위치 에너지 (mgh)} + \text{압력 에너지 (PV)} + \text{운동 에너지 } (\tfrac{1}{2}mv^2)$$

이 중에서 위치 에너지는 측와위에서 좌·우측 팔의 압력 비교와 같은 상황에서 고려의 대상이 되고, 앙와위에서는 영향이 적으므로 이번 논의에서는 제외하겠다. 이제 혈액이 가지는 에너지는 두 가지, 압력 에너지와 운동에너지만 남는다. 이 중 압력 에너지는 단위 부피에서 모든 방향으로 작용하게 되므로, 혈관 벽에서도 측정이 가능하고, 이것이 혈관 벽에 작용하는 현상을 측정하는 것이 비침습적 혈압(NonInvasive Blood Pressure, NIBP) 측정이다. NIBP 측정에서는 커프가 혈액의 흐름을 약간 방해하기 때문에, 운동 에너지 중 일부가 압력에너지로 변환되어 측정되지만 측정된 압력에 대한 기여는 상대적으로 적다. 반면에 IBP 측정 방법에서는, 카테터를 혈관 안에 꽂기 때문에 카테터 속으로 들어가는 혈액은 기본적으로 속도가 0이 되게 된다. 에너지 보존 법칙에 의해 총 에너지는 일정하게 되므로, 사라진 운동에너지는 압력 에너지로 변환되어 두 에너지의 합이 압력 측정 transducer의 piezoelectric crystal(압력을 전기 신호로 바꾸는 소자)에 작용하
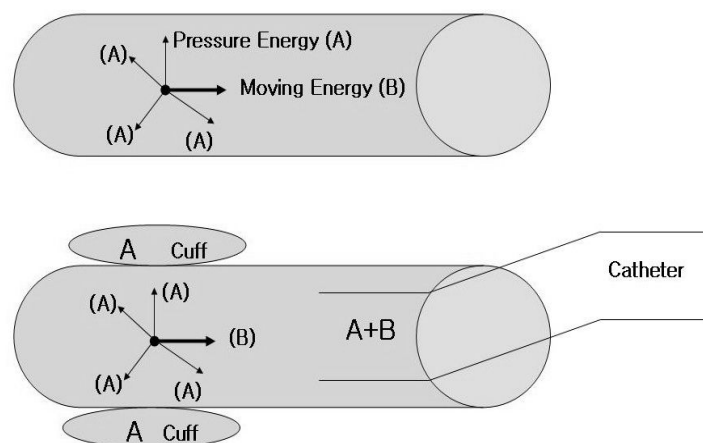
Fig. 1. Schematic drawing of the energy in blood and the targets of blood pressure measurement methods. Any blood particle in human artery has intrinsic pressure and moving energy. Noninvasive blood pressure (NIBP) monitoring methods measure lateral pressure (A) of blood vessel. In contrast, invasive blood pressure (IBP) monitoring method measure both pressure (A) and moving energy (B) of blood. Therefore, if each method measures correct target, the value of IBP has always greater than that of NIBP.

게 된다. 즉, IBP는 혈액 속의 압력 에너지와 운동 에너지를 합쳐서 측정하게 되는 것이다(Fig. 1). 그러므로 NIBP와 IBP가 오차 없이 측정 되었을 때는 항상 IBP가 높게 나오게 되는 것이다. 이러한 현상은, 혈액의 속도가 빠를 때 운동 에너지 성분($\frac{1}{2}mv^2$)이 커지므로 쉽게 관찰된다. 예를 들어, 전신 마취 유도 중 NIBP와 IBP를 동시에 측정하고 있다면, 기관 내 삽관 전에는 별 차이를 보이지 않던 두 혈압이 삽관 직후 혈압이 올라가면서 혈액 속도가 빨라질 때 많은 차이를 보이게 되는데, 이러한 차이의 원인은 측정 대상이 다르기 때문이다.

2) 측정 방법에 따른 측정값과 추정 값

측정자가 환자의 상완에 커프를 감고, 소리를 들어서 측정하는 전통적인 혈압(manual noninvasive blood pressure, MNIBP) 측정법은 커프의 압력을 예상되는 수축기 혈압보다 더 높게 올리고, 천천히 압력을 줄이면서 소리가 들리기 시작하는 시점을 수축기 혈압이라고 정의하고, 소리가 들리지 않는 시점을 이완기 혈압이라고 정의한다.[2] 이 측정법의 정확성 여부는 논외로 하고, 맞게 측정한다고 가정하자. 방법에서 유추할 수 있듯이, 이 측정법은 수축기 혈압(SBP)과 이완기 혈압(DBP)를 측정하고, 평균 혈압(MBP)은 추정하게 된다. 수술실이나 중환자실에서 사용하는 ANIBP는 커프 압력을 예상되는 수축기 혈압보다 올리고, 정해진 알고리즘에 따라 압력을 줄이면서 커프를 통해 전달되는 압력의 진폭(Amplitude of Oscillation Pressure, AOP)을 측정하게 된다. 이 방법은 AOP가 최대인 지점을 측정하여 MBP로 표시하고, 몇 군데를 더 측정하여 AOP 하강 추세선(또는 기울기)을 구한 후 추세선의 변곡점을 구하여 SBP와 DBP로 추정하거나 최대 AOP의 특정 비율이 되는 양 지점을 SBP와 DBP로 추정하게 된다(Fig. 2).[3] AOP가 처음 커지기 시작하는 지점을 직접 측정하여 SBP로 정하는 경우도 있다. 이 때 충분한 측정 시간을 가진다면 정확한 추세선을 구할 수 있고, SBP도 측정하여 정확도는 높일 수 있으나, 빠른 측정을 위해 측정 횟수를 줄여서 신속히 혈압을 결정하는 알고리즘을 회사별로 채택하여 사용하고 있다. 각 모니터 회사별로 구현한 구체적인 알고리즘은 회사의 기밀로 공개하지 않고 있다. 하지만 대부분의 측정법에서 MBP를 측정하게 되고, DBP 또는 SBP와 DBP를 알고리즘에 의해 추정하게 된다.

임상에서 사용하는 IBP 측정법은 측정 압력의 절대값과 위상에서 오차를 필연적으로 수반하여 변환 공식도 연구되어 있지만 이 글에서는 정확한 측정이라고 가정하겠다.[4] IBP 측정법은 혈액 에너지가 압력 측정 transducer의 piezoelectric
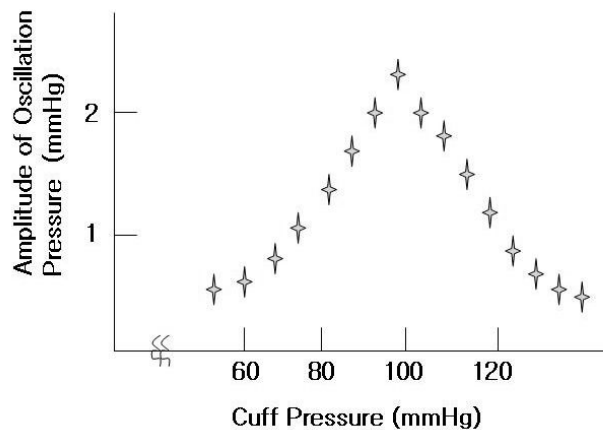
Fig. 2. The trend of amplitude of oscillation pressure (AOP) when cuff pressure is applied to an extremity. Automatic noninvasive blood pressure monitor measures amplitude of oscillation of applied pressure when cuff is inflated. The mean blood pressure (MBP) is determined by the maximum AOP. The systolic blood pressure (SBP) and the diastolic blood pressure (DBP) are determined by algorithm based on the slope of the AOP graph or on fixed ratios of AOP.3) Some monitors determine SBP when AOP starts to increase during deflation. In this example, monitor displays approximately 125/100/70 mmHg (SBP/MBP/DBP).

crystal에 작용하여 전압신호로 변환되어 아날로그 형태로 모니터에 전달되는 방식이 일반적이다. 모니터에서는 혈압 표시가 너무 자주 바뀌는 것을 방지하기 위해 몇 초의 시간 동안에 주어진 자료를 합하여 평균적으로 SBP, DBP를 표시하게 된다. 고급 모니터에서는 파형의 적분회로를 구현하여 MBP를 직접 계산하여 표시하기도 하지만, 저급 모니터에서는, 임상에서 많이 사용하는 MBP 추정식을 이용하여, SBP, DBP로부터 MBP를 추정하기도 한다. 하지만 후자의 방법은 SBP, DBP가 같으면서 파형의 모양이 다른 경우에 MBP를 같게 표시하는 단점이 있다.[5] 이 방법에서는 SBP, DBP는 측정하고, MBP는 계산하거나 추정하게 된다.

3) 비교 해석

임상에서 사용하는 세 가지 혈압 측정 방법(MNIBP, ANIBP, IBP)은 측정 대상이 다르거나 측정 값, 추정 값이 서로 다르다. 그러므로 서로 다른 측정 방법에 의해 구해진 혈압의 정확성 여부를 알아보기 위해 비교하거나, 상호간에 오차를 줄이는 시도를 하는 것은 타당하지 않다.[6] 또한, 연구 설계상 혈압이 중요한 변수로 선정된 경우에는 측정 방법을 명확히 명시하여야 연구의 신빙성과 재현성을 높일 것으로 생각된다. 그리고, 표시되는 세 가지 혈압 항목 중 하나를 선정하여 연구를 진행하고자 할 때는 측정 방법에 따라 SBP, DBP, MBP 중 어느 항목이 정확히 측정된 것이냐를 따져서 적절한 것을 선택하는 것이 좋을 것으로 생각된다.[7]

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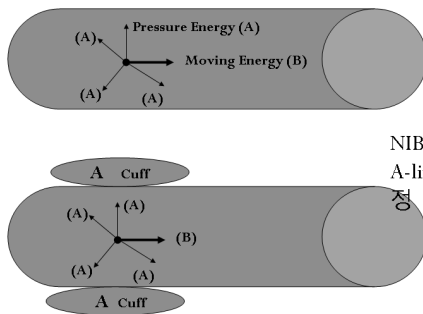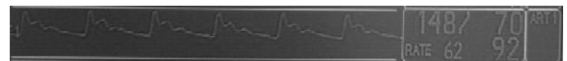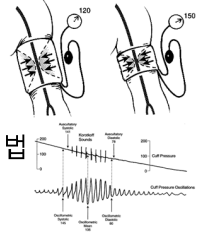
세 가지 혈압 측정법

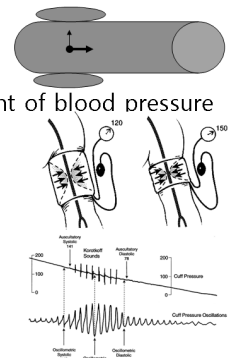서울의대 마취통증의학과

안 원 식

임상에서 사용하는 세 가지 혈압 측정법

- 수동 혈압 측정법
- 자동 혈압 측정법
- 지속적(침습적) 동맥압 측정법
- 어느 것이 맞는가?

NIBP: A 측정
A-line: A+B 측정

수동 혈압(NIBP) 측정

- 임상적 의미
  - Lateral component of blood pressure
- 측정과 추정 항목
  - 측정: SBP, DBP
  - 추정: MBP

자동 혈압 (NIBP) 측정
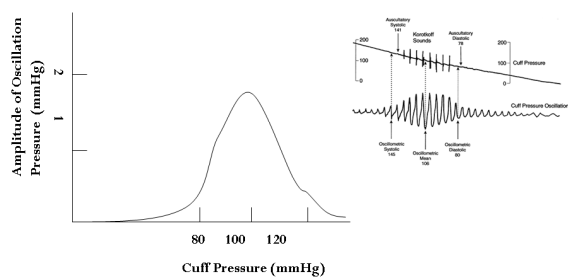
자동 혈압(NIBP) 측정

자동 혈압(NIBP) 측정
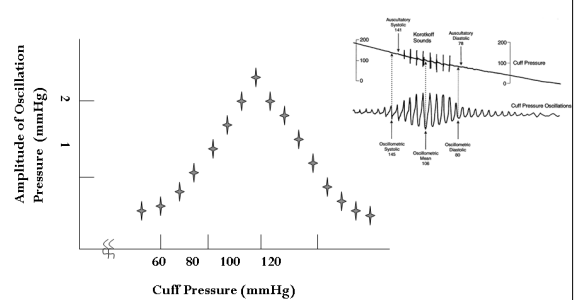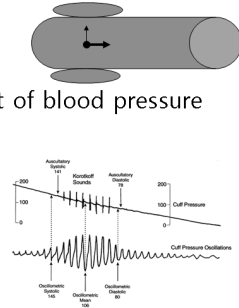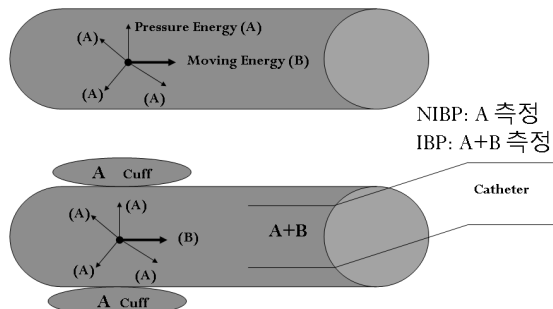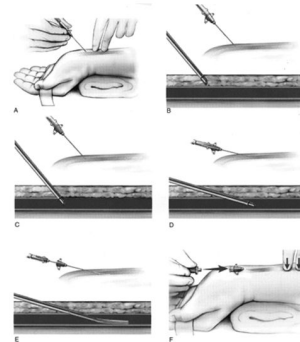

- 임상적 의미
  - Lateral component of blood pressure

- 측정과 추정 항목
  - 측정: (SBP), MBP
  - 추정: DBP
- 수동혈압 측정
  - 측정: SBP, DBP
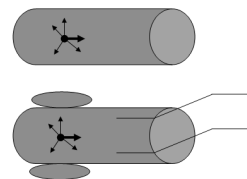 - 추정: MBP

Continuous pressure monitoring

NIBP: A 측정
IBP: A+B 측정

Continuous pressure monitoring

- 임상적 의미
  - Lateral component + moving component

- 측정과 추정 항목
  - 측정: SBP, MBP, DBP
- 수동혈압 측정
  - 측정: SBP, DBP
  - 추정: MBP
- 자동혈압 측정
  - 측정: (SBP), MBP
  - 추정: DBP

KOSOMBE
대한의용생체공학회

NIBP(Non-Invasive Blood Pressure) Measurement

2008 Nov.
Youngjoon Chee, Ph.D,
Biomedical Engineering
Hanyang University

Non Invasive Blood Pressure (NIBP) Measurement
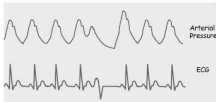
- 1. Auscultatory (Manual, Automatic)

- 2. Oscillometric (Automatic)

- 3. Validation of NIBP Devices

- 4. Research Directions of NIBP

Blood Pressure Measurement

- Invasive way
  - Arterial Line, Direct Measurement
  - Advantages
    - Beat-to-Beat Waveform (Continuous)
    - Direct Measurement
  - Disadvantages
    - Trauma to Artery
    - Risk of Infection
  - Gold Standard in Acute Care
  - Reference Pressure : Central Aortic

- Non Invasive way
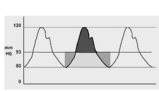
1733 Hales

IBP Displays

SBP
MAP, MBP
DBP

Arterial Pressure

ECG

---

1. Auscultatory Method

Inflatable cuff

Pressure gauge

Stethoscope

Cuff pressure > 120 mm Hg — no sound

Cuff pressure between 80 and 120 mm Hg — Systolic Pressure — sounds by turbulent pulsatile blood flow — I, II, III, IV, V
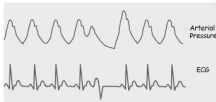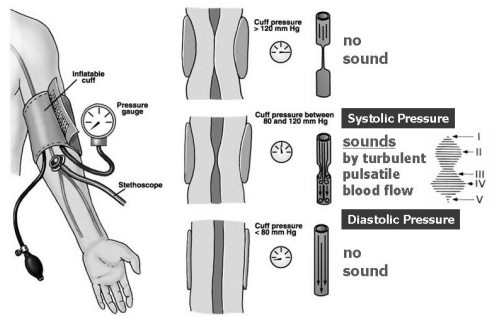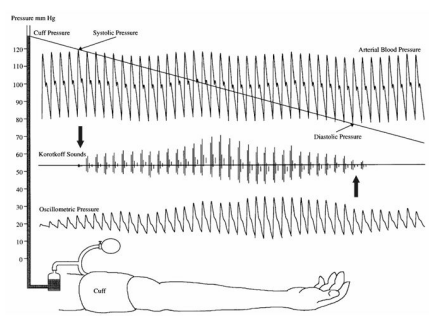
Cuff pressure < 80 mm Hg — Diastolic Pressure — no sound

Gold standard of NIBP measurement

Korotkoff's sound

Pressure mm Hg

Cuff Pressure   Systolic Pressure

Arterial Blood Pressure

Diastolic Pressure

Korotkoff Sounds

Oscillometric Pressure

Cuff

Auscultatory Method using Korotkoff Sound

- In 1905, Dr. Nikolai Korotkoff (1874-1920), a Russian surgeon.
- In 1939, AHA and the Cardiac Society of GB officially accepted.

- Still controversial
  - The Origin of K Sound
  - Phase IV, Phase V

- Guidelines

© Norton Publishing

ESH

American Heart Association®

Learn and Live℠

대한고혈압학회
혈압 모니터 지침
Blood Pressure Monitoring Guidelines

2. Oscillometric Method of NIBP Measurement
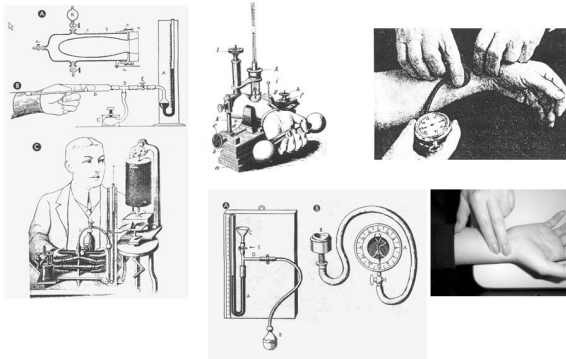
Oscillometric Method of NIBP Measurement
Most Popular Method in Automatic BP machine

Oscillometric Method : Principle

- Detection of MAP point,
  Estimation of SBP/DBP by stochastic algorithm
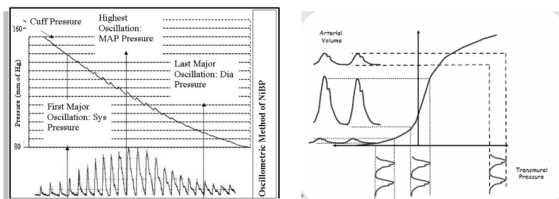
Oscillogram : Cuff Pressure in X-Axis (almost static pressure)
Oscillation Component in Y-Axis

Characteristic Ration : Dependent on Devices

Oscillometric Method : Device
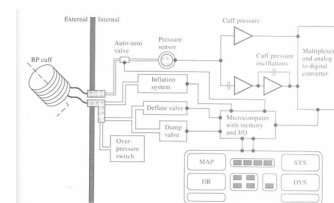
- A Mathematical Study of Some Biomechanical Factors Affecting the Oscillometric Blood Pressure Measurement, IEEE Trans. BME 43(8) 1996

Limitation 1 : Characteristic Ratio

- Detection of feature point : MAP
  - K-Sound : SBP, DBP
- Stochastic Estimation based on Characteristic Ratio
- CR for SBP : 0.46~0.64
- CR for DBP : 0.59~0.80

ideal

DBP Underestimation

SBP Underestimation

SBP Overestimation
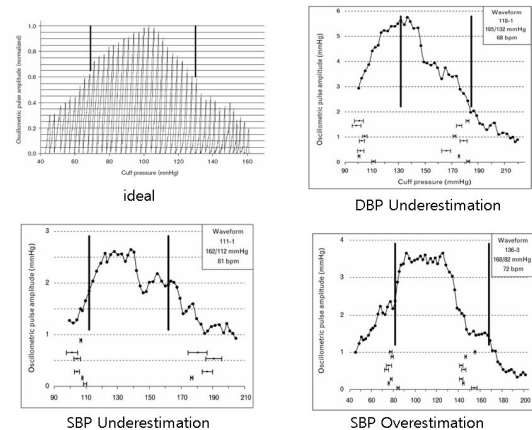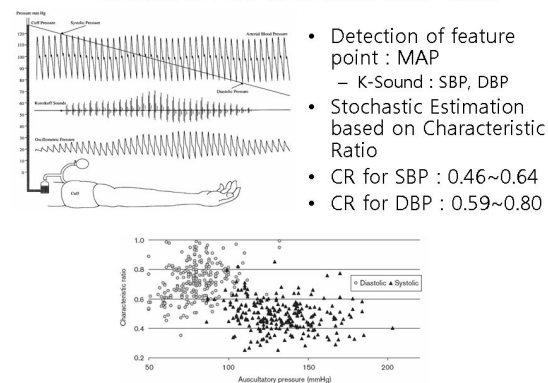
Limitation 2 : Motion Artifacts

Diagram 1A – Without Motion Artifact

Diagram 1B – With Motion Artifact

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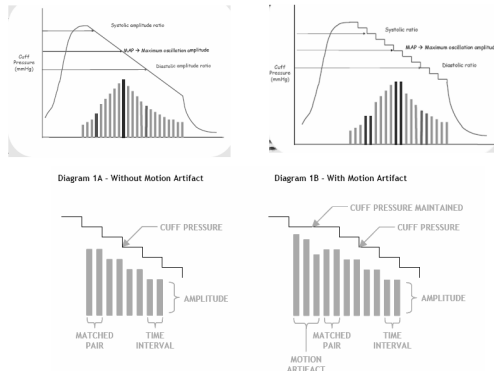
3. Validation of the NIBP Devices

- ANSI/AAMI SP10
  - 2002 and Amendment 1:2003
  - Manual, electronic or automated sphygmomanometers (and amendment)
  - Association for the Advancement of Medical Instrumentation
  - Safety : Electrical, Mechanical, Labeling
  - Performance : **Clinical Accuracy**, Transducer Accuracy

SP-10 Clinical Accuracy (Adult)

- Adult / Pediatric / Neonate(Infant)
- Reference : Auscultatory or Direct
- Two observer (Average)
- Subjects
  - >85 persons, 255 trials
  - SBP : 10% < 100mmHg, 10% > 160mmHg
  - DBP : 10% < 60mmHg, 10% > 100mmHg
  - Cuff, Arm Circumference
- Mean Error of 255 cases ≤ +/- 5mmHg
- Standard Deviation ≤ +/- 8mmHg

Specification Example of NIBP Module

Measurement	
Technique	Oscillometric
NIBP Accuracy	Meets ANSI/AAMI SP10-2002, EN 1060-4
Patient Applications	Adult, Pediatric & Neonatal
Systolic Range	
Adult	40 – 260 mmHg
Pediatric	40 – 160 mmHg
Neonatal	40 – 130 mmHg
Diastolic Range	
Adult	20 – 200 mmHg
Pediatric	20 – 120 mmHg
Neonatal	20 – 100 mmHg
Pulse Rate Range	30 – 220 BPM (Beats per min)
Pulse Rate Accuracy	± 2% or ± 3 BPM, whichever is greater
Transducer Accuracy	± 3 mmHg over full range in operating conditions

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3. Validation of the NIBP Devices

- Standards : Safety & Performance
  - ANSI/AAMI SP-10
  - IEC 60601-2-30
  - EN 1060
  - OIML 16-2
- Protocols : BHS(1993), ESH(2002)
  - British Hypertension Society
  - European Society of Hypertension
  - **Only deal with Performance as clinical accuracy**

The British Hypertension Society protocol for the evaluation of blood pressure measuring devices
Journal of Hypertension 1993, 11 (suppl 2):S43–S62

Working Group on Blood Pressure Monitoring of the European Society of Hypertension International Protocol for validation of blood pressure measuring devices in adults

Blood Pressure Monitoring 2002, 7:3–17

- Auscultatory as Reference
- 33 patients / 99 pairs of data
  - 4 auscultatory, 3 test device : sequential
- Phase 1 / 2
- 2 Observers : Training BHS
  - Nearest 2mmHg
- Pass / Fail

ESH 2002, subjects

Number	Phase 1 Fifteen subjects Phase 2 Thirty-three subjects
Sex	Phase 1 At least five male and five female Phase 2 At least 10 male and 10 female
Age range	All subjects should be at least 30 years of age

Table 1 Blood pressure ranges for entry blood pressure (BPA)

	SBP	DBP
Low	90–129	40–79
Medium	130–160	80–100
High	161–180	101–130

For the primary phase, five of the 15 subjects should have a systolic blood pressure (SBP) in each of the ranges. Similarly, five of the 15 subjects should have a diastolic blood pressure (DBP) in each of the ranges. For the secondary phase, 11 of the 33 subjects (including the first 15 subjects) should have SBP and DBP in each of the ranges. It is recommended that recruitment should commence by targeting subjects likely to have pressures in the low-systolic and high-diastolic ranges, then progressing to complete the high-systolic and low-diastolic ranges so that it will be easy to complete the recruitment with the remaining medium ranges.

Criteria for "Pass/Fail", ESH 2002

- Phase 1
  - 15 persons, 45 measurements
  - CONTINUE/STOP
- Phase 2.1
  - 33 persons, 99 measurements
- Phase 2.2
  - 3 measurements per subjects

Table 2a Requirements to pass phase 1

Measurements	Within 5 mmHg	Within 10 mmHg	Within 15 mmHg
At least one of	25	35	40

Table 2b Requirements to pass phase 2.1

Measurements	Within 5 mmHg	Within 10 mmHg	Within 15 mmHg
Two of	65	80	95
All of	60	75	90

Table 2c Requirements to pass phase 2.2

Subjects	2/3 within 5 mmHg	0/3 within 5 mmHg
At least	22	
At most		3

ESH 2002, Example of Report

Table 3 Example of device validation table in report

| Phase 1		within 5 mmHg	within 10 mmHg	within 15 mmHg	Recommendation
Required	One of	25	35	40	
Achieved	SBP	22	35	43	Continue
	DBP	35	42	44	Continue
Phase 2.1		within 5 mmHg	within 10 mmHg	within 15 mmHg	Recommendation
Required	Two of	65	80	95	
	All of	60	75	90	
Achieved	SBP	52	79	90	Fail
	DBP	77	90	94	Pass
Phase 2.2		2/3 within 5 mmHg	0/3 within 5 mmHg		Recommendation
Required		≥22	≤3		
Achieved	SBP	17	4		Fail
	DBP	28	2		Pass

The device passes for diastolic blood pressure (DBP), but fails for systolic blood pressure (SBP), thereby failing overall.

Blood pressure measuring devices: recommendations of the European Society of Hypertension

Eoin O'Brien, Bernard Waeber, Gianfranco Parati, Jan Staessen, Martin G Myers on behalf of the European Society of Hypertension Working Group on Blood Pressure Monitoring

	Absolute difference between standard and test device (%)		
Grade	≤5	≤10	≤15
A	60	85	95
B	50	75	90
C	40	65	85
D		Worse than C	

Summary points

Two manual sphygmomanometers have been validated, one is recommended

Five devices for clinical use in hospitals have been validated, two are recommended

23 devices for self measurement of blood pressure have been validated, five are recommended

24 devices for ambulatory measurement of blood pressure have been validated, 16 are recommended

Validations and recommendations will be updated on the *BMJ's* website

Device	AAMI*	BHS (systolic/diastolic)†	Use	Recommendation
Omron HEM-400C	Failed	Failed	At rest	Not recommended
Philips HPS308 (auscultatory mode)	Failed	Failed	At rest	Not recommended
Philips HPS306/B	Failed	Failed	At rest	Not recommended
Healthcheck CX-5 06002/P	Failed	Failed	At rest	Not recommended
Nissei analogue monitor (auscultatory mode)	Failed	Failed	At rest	Not recommended
Systema Dr MI-150	Failed	Failed	At rest	Not recommended
Fortec Dr MI-100	Failed	Failed	At rest	Not recommended
Philips HPS532	Failed	C/A	At rest	Not recommended
Nissei DS-175	Failed	D/A	At rest	Not recommended
Omron HEM-705CP	Passed	B/A	At rest	Recommended
Omron HEM-706	Passed	B/C	At rest	Not recommended
Omron HEM-403C	Failed	C/C	Protocol violation	Not recommended
Omron HEM-703CP	Passed	NA	Intra-arterial	Questionable recommendation
Omron M4	Passed	A/A	Only abstract available; details missing	Questionable recommendation
Omron MX2	Passed	A/A	Only abstract available; details missing	Questionable recommendation
Omron HEM-722C	NA	A/A	Protocol violation	Questionable recommendation
Omron HEM-722C	Passed	A/A	At rest in elderly people	Recommended
Omron HEM-735C	Passed	B/A	At rest in elderly people	Recommended
Omron HEM-713C	Passed	B/B	At rest	Recommended
Omron HEM-737 Intellisense	Passed	B/B	At rest	Recommended
Visomat OZ2	Passed	C/B	At rest	Not recommended

AAMI=Association for the Advancement of Medical Instrumentation; BHS=British Hypertension Society; NA=not applied.
*To meet AAMI criteria the mean difference between the device and the mercury standard must be ≤5 mm Hg or the standard deviation must be <8 mm Hg.
†To meet BHS criteria devices must achieve a grade of at least B for both systolic and diastolic measurements. Grade A denotes greatest agreement with mercury standard and D denotes least agreement.

---

4. Research Directions in NIBP

- 1. Oscillometric Method for Automated NIBP is not finished until yet !
- 2. Cuffless Measurement
- 3. Non-Invasive Continuous (Beat-to-Beat) Measurement
- 4. Blood Pressure Variability and Autonomic Nervous System

- **Oscillometric Method**
  - Detection of MAP, estimation of SBP/DBP
  - Too big errors for some patients/children
  - We don't like the cuff !
- **Automated auscultatory method**
- **Secondary sensors with cuff**
  - Ultrasound, Photoplethysmography
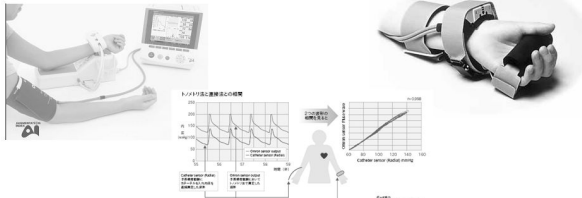

Global Patient Monitoring Market
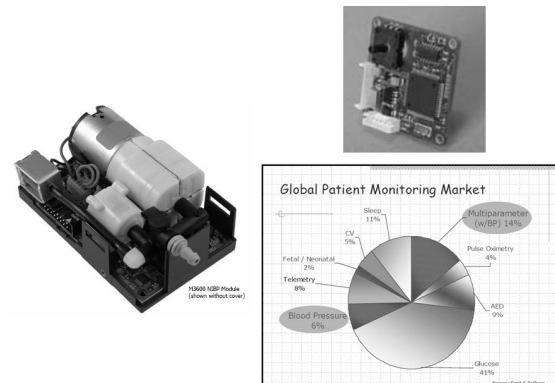
Tonometry

ADVANTAGES
+) Can be used for *non-invasive, non-painful, continuous* measurement

DISADVANTAGES
-) Relatively high cost
-) The wrist movement and tendons result in measurement inaccuracies

---

AtCor Medical, SphygmoCor

- SphygmoCor Px
  - Aotic BP Waveform Analysis
- SphygmoCor Vx
  - Pulse Wave Velocity
- SphygmoCor HRV
- SphygmoCor Mx
  - Continuous Aortic Monitoring

- Tonometer
- AI, PWV, HRV
- Aortic Waveform Analysis

AtCor Medical Pty Ltd
Suite 11, 1059 - 1063 Victoria Road, West Ryde NSW 2114 Australia
T: +61 2 9874 8761   F: +61 2 9874 9022   E: inquiry@atcormedical.com
www.atcormedical.com

Medison Econet

B PRO : Modified Applanation Tonometry

Model	T6200 series
Display	LCD, 20 mm X 20 mm 2 lines
Displayed parameters	
- ABPM mode	Systolic pressure in mmHg Diastolic pressure in mmHg Pulse rate in beats/minutes
- PWA mode	Pulsation bar
Memory (For ABPM)	96 blocks of waveform readings
Reading cycle time (For ABPM)	8 to 10 seconds
Measurement range	
- Blood pressure	40 to 280 mmHg
- Pulse rate	30 to 180 beats/minute
Power source	3V CR 2032 coin battery
Battery life	1 ~ 6 months depending on usage

Performance of Colin	Measuring Range	SYS: 60~250mmHg(ADT), 40~120mmHg(Neo) MAP: 45~235mmHg(ADT), 30~100mmHg(Neo) DIA: 40~200mmHg(ADT), 20~90mmHg(Neo)
	NIBP Accuracy	Average:±5mmHg, SD: 8mmHg(AAMI SP~10)
	Pulse Rate Range	40~200bpm(ADT) , 40~240bpm(NEO)
	PR Accuracy	2bpm(±2%)
	UART	1200~19200bps
	Protocol	Colin protocol

Sensor Housing
Median Nerve
Ulnar Bone
BPro Monitor
Sensor Plunger
Wrist Strap
Radial Artery
Radius Bone

Vascular Unloading
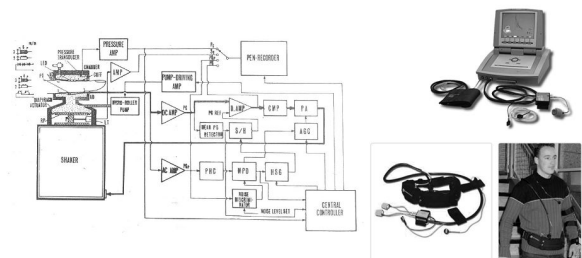
- Finapres : Ohmeda → Finometer(FMS)
- Portapres(FMS) : www.finapres.com
- CNSystem : Task Force Monitor : www.cnsystems.at

Jetfly Technology Ltd. Hongkong
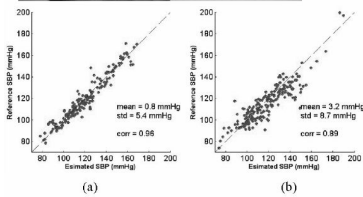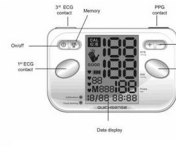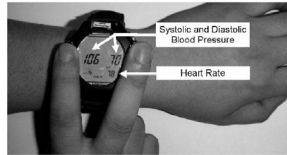
For further reading

European Society of Hypertension recommendations for conventional, ambulatory and home blood pressure measurement
Journal of Hypertension 2003, 21:821–848

Oscillometric blood pressure measurement: progress and problems
Gert A. van Montfrans
Blood Pressure Monitoring 2001, **6**:287–290

What will replace the mercury sphygmomanometer?
Thomas G. Pickering   Blood Pressure Monitoring 2003, 8:23–25

Working Group on Blood Pressure Monitoring of the European Society of Hypertension International Protocol for validation of blood pressure measuring devices in adults
Blood Pressure Monitoring 2002, 7:3–17

비침습적 혈압 측정의 의학적 고찰

서광석

서울대학교 치과마취과

혈압 측정의 목적은 일차적으로 고혈압을 진단하고 고혈압이 판정되었을 때 그 치료 효과를 지속적으로 감시하여 고혈압으로 인한 합병증을 예방하는 데 이용하는 것이다. 이러한 목적의 혈압 측정에는 기본적으로 비침습적인 혈압계가 사용되며, 고전적인 청진기를 이용한 혈압계, 오실로메트릭법을 이용한 혈압계 등이 흔히 사용된다. 최근 고혈압의 진단에 ambulatory blood pressure monitoring의 의미가 중요해 지면서 가정에서 지속적으로 혈압 측정과 기록이 되는 기계들이 수요가 증가하고 있다. 이러한 24시간 지속 혈압측정방법은 가면고혈압(masked hypertension)등을 진단해 줄 뿐만 아니라 고위험성 고혈압을 진단하는 데 도움을 줄 수 있다는 보고들이 나오고 있다.

비침습혈압 측정은 고혈압의 진단 이외에도 임상 진료 시 여러 형태로 이용이 된다. 응급실에 환자가 의식 없이 내원하였을 경우 출혈 등의 쇼크가 상태인지, 악성고혈압으로 뇌출혈등의 상태인지를 빠르게 평가할 수 있게 도와 준다. 그 뿐만 아니라 통증이나 불안 또는 긴장으로 혈압의 상승이 예상되는 진료에서 사전에 혈압을 측정하여 혈압이 높은 경우 혈압이 정상으로 될 때까지 (치료하여) 연기하거나, 혈압을 지속적으로 감시하면서 치료를 하는 경우에 사용이 된다. 이렇게 혈압을 지속적으로 감시하는 것이 필요한 치료의 대표적인 경우가 전신마취 또는 진정법 등을 이용하여 수술이나 침습적인 진료를 하는 경우이다. 물론 급격한 혈압 변화가 예상이 될 때는 비침습적인 혈압 측정 보다는 침습적인 혈압 측정기가 사용될 때도 있다. 하지만 이러한 침습적인 혈압 측정이 유용할 지 않을 경우에는 여러 가지 비침습적이면서 지속적인 혈압 측정을 위한 기구들이 이용될 수 있다. 커프를 이용한 혈압을 일정한 간격을 두고 측정을 하는 것이 일반적이지만, 비침습적으로 맥파를 이용하여 지속적으로 혈압을 측정하는 방법도 현재 임상에 사용 중이며 일부는 연구 및 개발 중이다.

이번 발표에서는 비침습적 혈압 측정이 이용되는 의학적 상황과 그 의미에 대하여 소개하려고 한다.

침습적 혈압측정의 공학적 해석

강원대학교 최성욱

목적

- 침습적 혈압측정기의 원리 및 구조 설명

- 제품의 평가 방법 고찰

침습적 혈압측정의 물리적 원리

- 파스칼의 원리

- Bernoulli 법칙

- 정수압

- 관성, 탄성, 댐핑 성분을 가진 이차미분 방정식으로 표현되는 모델

피스톤이 올라간다
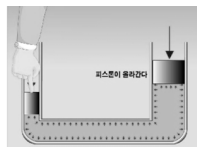
Mechanism of Pressure Sensor

- Fiber optic sensors
- MEMS
- Mechanical deflection
- Strain gauge
- Semiconductor (piezoresistive)
- Vibrating elements (silicon resonance, for example)
- Variable capacitance

Fiber Optic Pressure Sensors

Light Source (LD) → 2 by 1 Coupler → Sensor
Output (PD)

Thin Film
Single Mode Fiber
E, E_1

MEMS
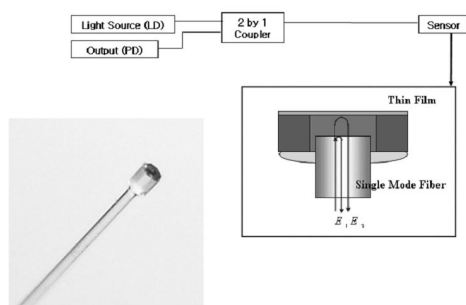
MEMS pressure sensors have always provided easy interface to an MCU, reliability, and low cost. New manufacturing processes and designs have reduced their die sizes while enhancing their performance
Jul 1, 2000 By: Gordon Bitko, Randy Frank, Andrew McNeil Sensors
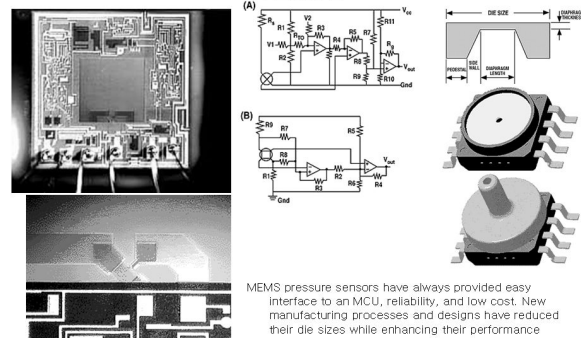
Piezoresistive Pressure Sensor

Absolute sensor

Gauge/ Differential sensor

- Absolute, Vacuum, Sealed
- Differential, Gauge

IBP 센서의 종류

- Fluid filled(Reusable, Disposable)
  (Piezo-resistive transducer)
- Implantable pressure catheter

Excitation (-)

Excitation (+)   Signal (+)

GND
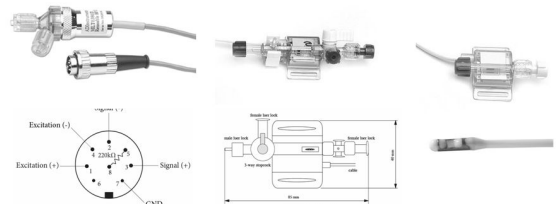
Wheatstone bridge와 온도보상

+Exc

RFSOTC   RFSOTC-SHUNT

ROTC-SHUNT   ROTC-NEG

+Vout   -Vout

RBIAS TRIM   ROTC-POS

-Exc

A Temperature
Compensated Bridge
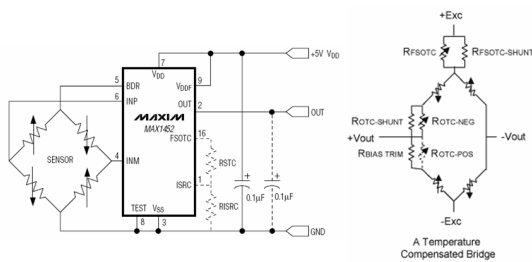
혈압측정기의 부속

- Infusion set(Needle)
- Tube(hose)
- 3 way
- Holder
- Transducer
  (Membrane sensor, Dome, Diaphragm)

튜브의 수학적 모델

- 관성(L)
- 탄성(1/C)
- Damping(R)
- 주파수 특성

$$L\frac{dF}{dt} + RF + \frac{1}{C}\int (F - F_{leak})dt$$

L   R $R_{Leakage}$

C
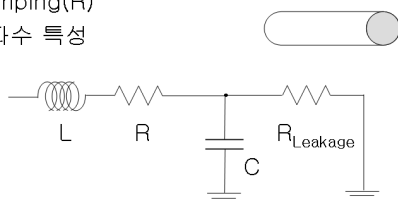
혈압측정에 영향을 미치는 요인

- 센서의 위치: 정수압의 변화
- 기포: Compliance(C)의 증가
- 꺽임: R의 증가
- Dome 이나 관의 누수

Invasive BP Monitor의 구조
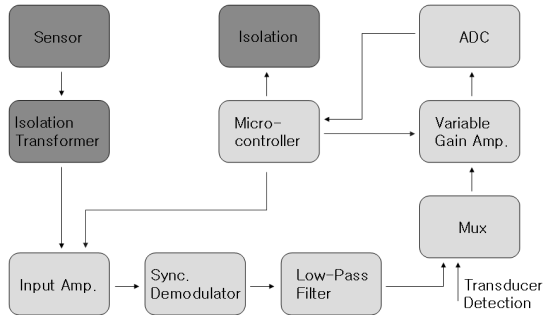
Transformer circuit(1)
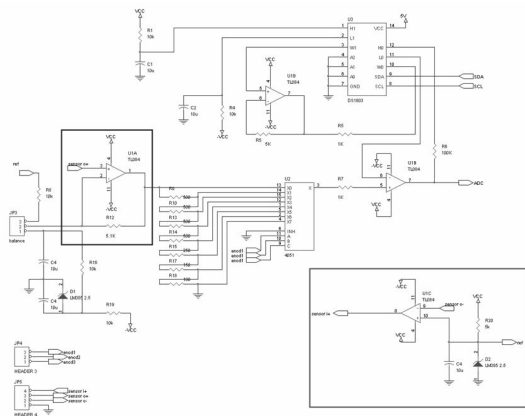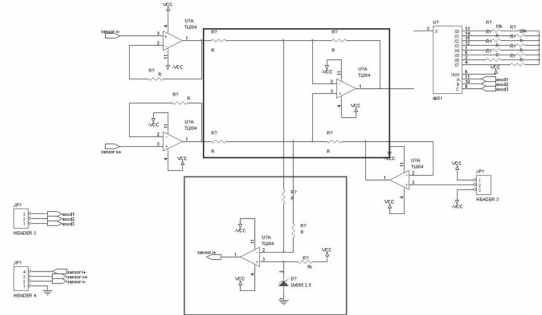
일반 기능 및 특수 기능
(Solar 8000, GE, USA)

- Transducer requirements:
  - Excitation voltage: ±2.5 V dc ±0.1%
  - Transducer output: 50 mV/V/cm Hg
- Input specifications:
  - Range: −25 mmHg to 300 mmHg
  - Offset: ±150 mmHg
  - Input impedance:
    Common mode: >100 K at 50/60 Hz
    Differential: >100 K from dc to 60 Hz
- Displayed frequency response:
  0 to 12 Hz or 0 to 40 Hz (−3dB) user-selectable
- Display scale selections:
  0−30,0−40,0−60,0−100,0−160,0−200,0−300 mmHg

일반 기능 및 특수 기능
(Solar 8000, GE, USA)

- Output specifications:
  - Gain: 976 ±1%
  - Frequency response: dc to 50 Hz (+0/−3 dB)
  - Gain stability: <±0.1%/°C,
  - Zero balance range: ±150 mmHg
  - Zero balance accuracy: ±1 mmHg
  - Zero balance drift: ±1 mmHg over 24 hours
  - Common mode rejection: >60 dB at 60 Hz
  - Noise: <5 mV peak to peak from dc to 30 Hz
  - Accuracy: ±2% or ±1 mmHg, whichever is greater (exclusive of transducer)
- Analog output: 1 V / 100 mmHg
- Alarms: User selectable upper and lower limits for systolic, diastolic, and mean pressures; range −99 to 350 mmHg

Regulation

- IEC60601−2−34
  - Air leakage (10s, 400mmHg)
  - Leakage current(0.05mA)
  - Mechanical strength (1m freefall)
  - Electrostatic discharge(6000V, 8000V)
  - Radiofrequency electromagnetic fields
    (3V/m−1~5Hz, 150k~80mHz, 3A/m)
  - 4000mmHg(1s),−400 mmHg(1s),
  - Defibrillator discharge, Electro Surgical Unit
    (10s), (300W cut, 100W coagulation 450kHz 10 s)
  - Accuracy : hysteresis: 4% (4 mmHg),
          systolic diastolic pressure : 4%
    frequency response : 0~10 Hz, 10 Hz(3dB)
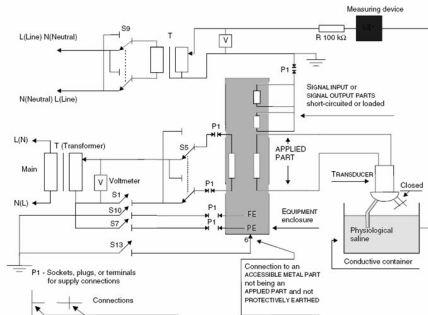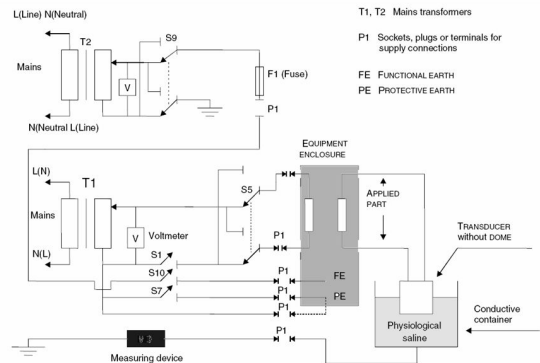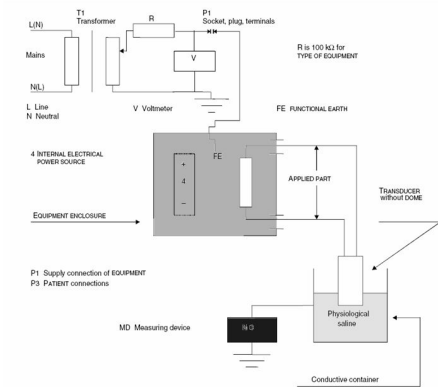
Leakage Current Measurement
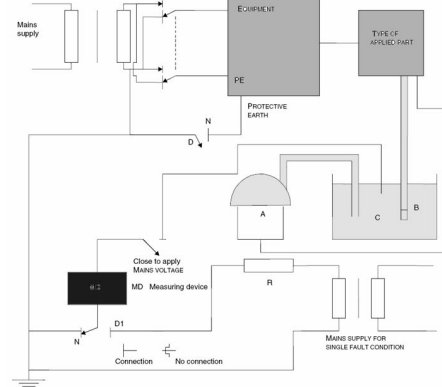
Fig. 101

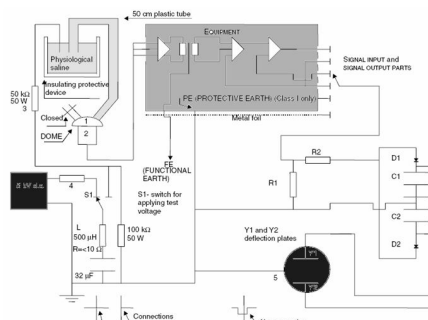Fig. 103

Fig. 104

Fig. 105

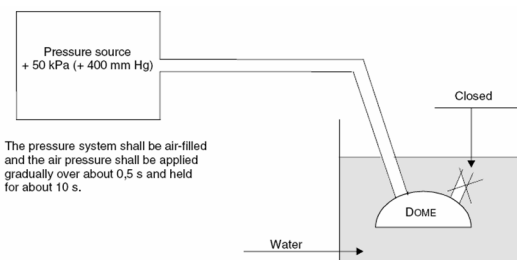# Energy Limitation/ Recovery Test

Fig. 102

Diaphragm leak test

Fig. 106
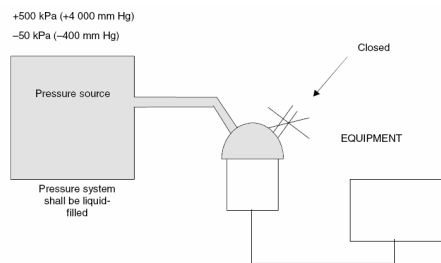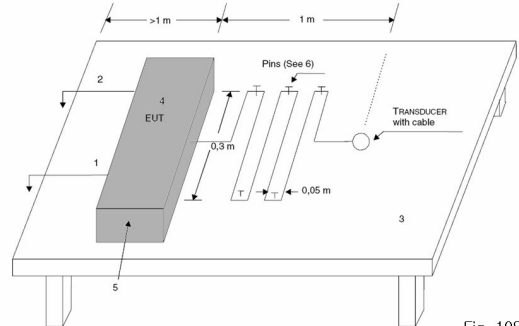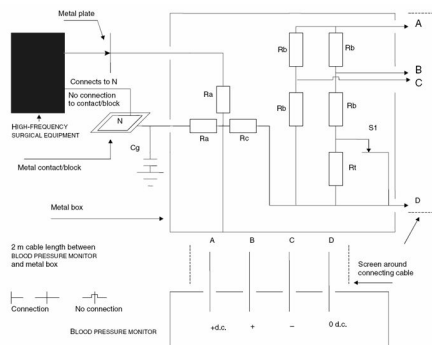
Fig. 107

Fig. 108

Fig. 109

Fig. 110

Fig. 111

Fig. 112

Accuracy of systolic diastolic pressure

Frequency response
Alarm delay test

Fig. 114
115
116

Sensitivity, repeatability, non-linearity, drift, hysteresis

Fig. 113

Mikro-Tip Catheter (PowerLab Systems)

Pressure Volume Measurement

Invasive Blood Pressure Monitoring: From a Clinical Medicine Perspective

Jae-Hyon Bahk, MD

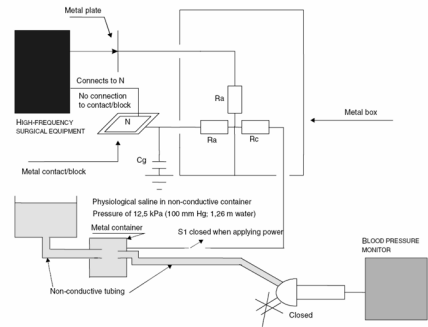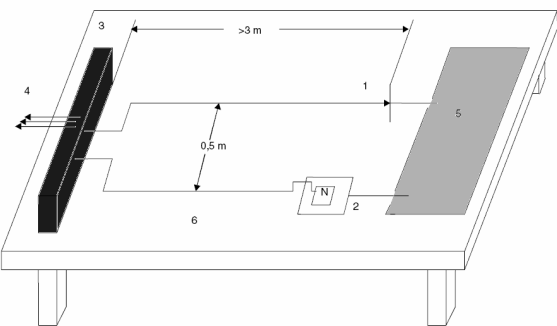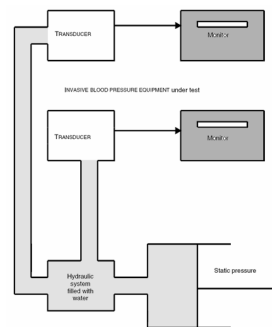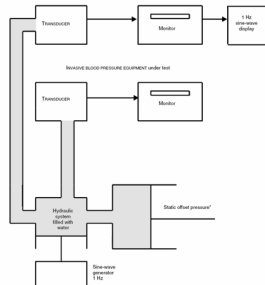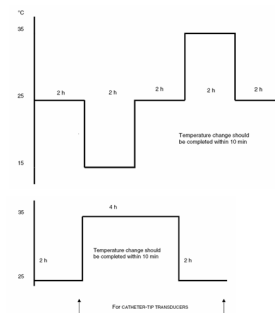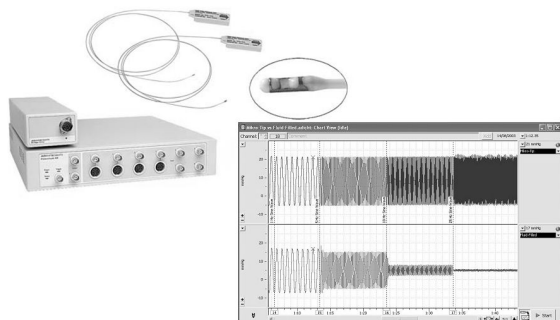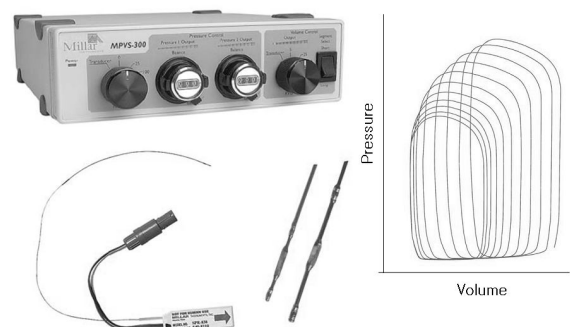Department of Anesthesiology and Pain Medicine, Seoul National University College of Medicine, Seoul, Korea

A primary goal of all hemodynamic therapeutic interventions is to optimize cardiovascular function in order to ensure adequate tissue oxygenation.

Commonly Used Hemodynamic Monitoring Techniques (in order of invasiveness):
Palpation, SpO_2, noninvasive blood pressure (NIBP), ECG, Arterial line, minimally invasive CO, CVP ($ScvO_2$), transesophageal echocardiography (TEE), Pulmonary artery catheterization ($SmvO_2$)

It is flow rather than pressure that balances O_2 demand and supply to the tissues.

Components for the invasive BP monitoring system
  ① Arterial cannulation with a catheter
  ② Fluid-filled tubing: de-airing
  ③ Transducer: leveling, zeroing & calibration
  ④ Patient monitoring system

Invasive BP monitoring system
Interaction between damping coefficient and natural frequency
Clinical measurement of natural frequency and damping coefficient
Fast-flush test: Fn (14.7 Hz) is determined by measuring the period of one cycle of adjacent oscillation peaks (1.7 mm) on standard 1-mm grid paper at a speed of 25 mm/sec.

Pulse contour cardiac output monitoring: Arterial pressure analysis
  ① PiCCO: transpulmonary thermodilution calibration and femoral artery
  ② LiDCO: lithium dilution calibration and radial or brachial artery
  ③ FloTrac & Vigileo: without calibration and radial artery

Stroke Volume Variation(SVV) $\propto$ Pulse Pressure Variation (PPV)

Monitoring devices themselves do not save patients.
Early, aggressive & appropriate interventions do save patients.

특 강

- Publishing in Biomedical Engineering.
  Prof. Jos A.E. Spaan, MBEC Editior-in-Chief

- Bioengineering, Translational Research & Technology commercialization
  Prof. Yongmin Kim (Department of Bioengineering, University of Washington)

Publishing in Biomedical Engineering.

Jos A.E. Spaan

Editor in Chief of Medical & Biological Engineering & Computing.
Prof. Medical Physics, Academic Medical Center University of Amsterdam

Engineering and Medicine have rather different traditions of publishing. For the medical research profession it holds already for decades that quality of researchers are judged by the number of papers, the impact factor, IF, of the journal in which is published and the number of citations to the papers. In the engineering community we liked to judge each other by different merits like patents, the applicability of our research outcome and the durability of our ideas. However, biomedical Engineering is at the cross roads of the two disciplines and hence we are judged in part by the same standards as our medical colleagues. This holds especially true when a biomedical engineer is working in a medical academic institution.

In this time of information technology it so easy to get access to one's scientific profile. Web of Science instantly provides a list of someone's publications and the citations to each paper on the list. Moreover, the Hirsch factor, h-index, is presented which represents the number of papers of an author that are cited equal or more often than the h-index. Worldwide, more and more we are evaluated by these publication indicators. The time has past that we can be proud to publish a paper once a year in a traditionally highly respected journal in our field but low impact factor. Hence, we have to adapt to a new career style. Also for us it is: Publish or Perish.

In this presentation the meaning of the different quality indicators for publications and journals will be discussed and especially Biomedical Engineering will be compared with the fields in medicine and Molecular Biology. It will be explained how MBEC is developing policies to increase its impact factor since our community is best served by well performing journals. Further it is discussed how to select best a journal for your paper. On the one hand one may opt for the highest IF, but on the other hand because of the quality indicators based on citations of papers wherever published, other factors then IF become relevant. These other factors are the audience aimed at and the accessibility of the journal. In this respect the possibility of 'Open Choice' will be discussed where, for a price, the publisher guarantees that for all times to come the paper can be downloaded free of charge.

In case we want to increase the stature of Biomedical Engineering in our academic institutions we have to take care of visibility of our profession for which our journals are of paramount importance. This makes publishing in this time frame an exciting activity.

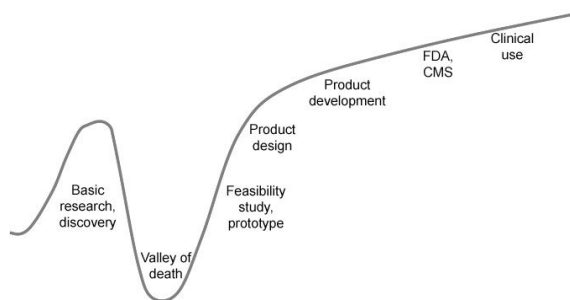## BIOENGINEERING, TRANSLATIONAL RESEARCH & TECHNOLOGY COMMERCIALIZATION

Yongmin Kim, Ph.D.
Professor of Bioengineering
Professor of Electrical Engineering
Adjunct Professor of Computer Science & Engineering and Radiology
University of Washington
Seattle, WA 98195 U.S.A.
IEEE-EMBS Past President 2007

November 14, 2008
KOSOMBE Conference
Seoul, KOREA

MEDICAL DEVICES

- Technologies & Methodologies
  - Biosignal Processing
  - Biomedical Imaging: Molecular, X-rays, CT, MRI, PET, ultrasound and optical imaging
  - Medical Instrumentation & Sensors
  - MEMS and Nanotechnology
  - Neural Engineering
  - Rehabilitation Engineering
  - Biorobotics
  - Biosystems Modeling
  - Computational bioengineering and bioinformatics

- Diagnostic systems
  - Conventional systems
  - Point-of-care diagnostics
  - Imaging and other tests
- Therapeutic systems
  - Neuromuscular devices
  - Cardiovascular devices
  - Cancer treatment
  - Drug delivery
  - Artificial tissues & organs:
    - Silicon retina, cochlear, tactile sensors, …
- Healthcare and bioinformation systems
  - MIS
  - E-medicine & telemedicine
  - D2H2
  - Genomics. Proteomics,and Physiome
  - Tools in drug discoveries

INNOVATION & TECHNOLOGY COMMERCIALIZATION STAGES

Basic research, discovery — Valley of death — Feasibility study, prototype — Product design — Product development — FDA, CMS — Clinical use

DEPARTMENT OF BIOENGINEERING UNIVERSITY OF WASHINGTON

- Was set up in 1967. Belongs to the College of Engineering and the School of Medicine
- 22 tenure-track, 7 research and 3 other faculty members
- 105 Ph.D. and 143 undergraduate students
- 31 MME students
- 60 postdocs and 82 research staff & support personnel
- 5 thrust areas for integrated education/research
- Outstanding and talented faculty
- >$27 Million external research funding per year (2007)
- Ranked #1 in NIH funding
- #1 in UW in IP generation
- Long history in creating and working with industry

HIGHEST DEGREES BY UW BIOENGINEERING FACULTY

- 32 faculty including active emeritus faculty
- 5 MDs and 29 Ph.D.s
- 29 Ph.D.s from the following disciplines
  - 10 in Engineering
  - 5 in Chemistry
  - 4 in Cellular/Molecular Biology
  - 3 in Physics
  - 2 in Biochemistry
  - 2 in Physiology
  - 1 in Mathematics
  - 1 in Pharmacology
  - 1 in Psychology

TRAINING NEXT GENERATION: BS BIOE COURSE REQUIREMENTS

Mathematics	25 cr.
Natural Science	48 cr.
Engineering Fundamentals	17 cr.
Bioengineering Core	38 cr.
Bioengineering Senior Electives	15 cr.
Written & Oral Communication	8 cr.
VLPA & I&S	24 cr.
Approved Electives	5 cr.
TOTAL	180 cr.

UW BIOENGINEERING BUILDING

-265k gsf (122k)
-147k asf (65k)
-Waited for 39 years
-Moved in Feb~April '06
-Opening Celebration on March 8, 2006
-$64M gift from Gates Foundation
-$10M gift from Whitaker Foundation
-$12M from federal government
-More gifts from individuals and corporations

BUILDING DEDICATION on MARCH 8, 2006
Former President Jimmy Carter

- "Bioengineering's incredible potential for global healthcare"

BIOENGINEERING BUILDING DEDICATION

Dr. William Foege

Bill Gates

BIOENGINEERING LAB TOUR

BIOENGINEERING LAB IN THE 1960s
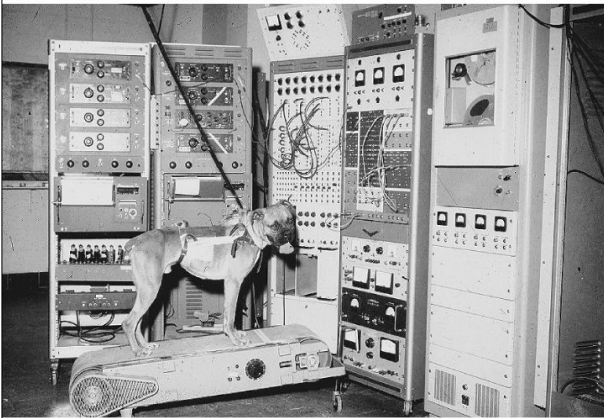
QUINTON INSTRUMENTS

THE BEGINNING OF MODERN ULTRASOUND: FIRST PRACTICAL TRANSCUTANEOUS DOPPLER FLOW DETECTOR (SUMMER 1964)
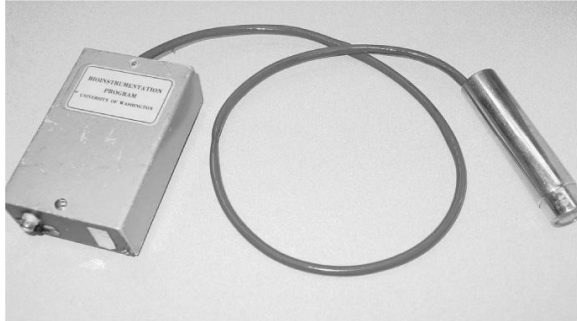
FIRST TECHNOLOGY TRANSFER & UW ULTRASOUND LEADERSHIP

• During the 1960s, UW Bioengineering researchers developed the first ultrasound instrument sold in the United States, called Dopotone®, by Smith-Kline Instrument Company

• Used primarily for detecting the heartbeat of an unborn fetus and measuring characteristics of the circulatory system

• In 1974, ATL launched medical ultrasound business based on UW Bioengineering technology

• In 1998, Philips Medical Systems acquired ATL for $800M

• Many other ultrasound companies, both diagnostic and therapeutic, have sprung up, making the Puget Sound area the leader in medical ultrasound in the world

PHILIPS

BRIDGING THE VALLEY OF DEATH

Translational Research

Clinical use

FDA

Product development

Product design

Feasibility study, prototype

Basic research, discovery

Valley of death
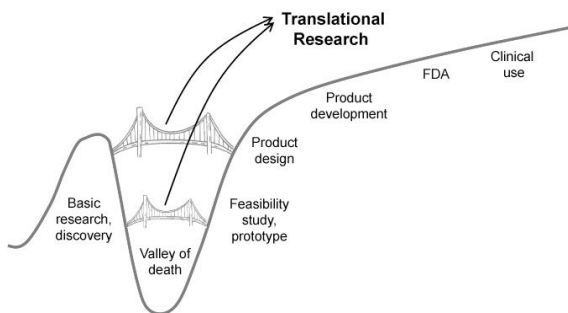
ENTREPRENEURIAL & IP ACTIVITIES

• 30 start-up companies (out of UW's total of 205)

• 470 inventions disclosed (25 in 2006 out of 226)

• 210 patents issued (15 from 7/1/06 to 6/30/07) to UW Bioengineering faculty/staff/students

• 80 commercial licenses

• Thousands of jobs created

• Multi million $ royalties and license fees

All-in-one PAP Smear Analysis

Angioplasty Tool

Boston Scientific

UW BIOENGINEERING

TRiPATH care technologies

micronics
all you need from sample to solution

sonicare

The Sonic Toothbrush

Lab-on-a-chip Diagnostic Tool

SonoSite
Portable Ultrasound Machines
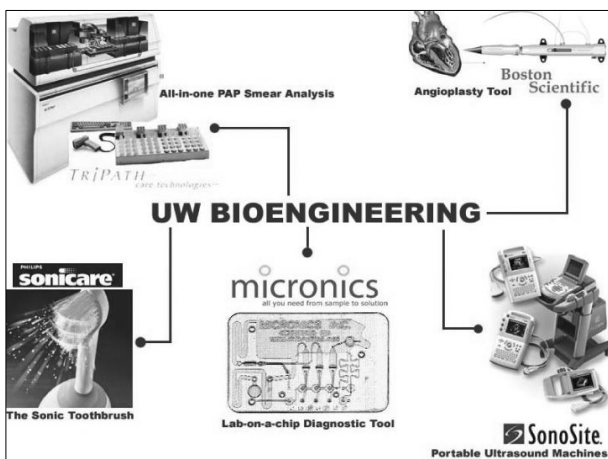
BIOENGINEERING THRUST AREAS

CLINICAL USE

Engineered Biomaterials & Tissue Eng.

D_2H_2

Mol. Bioe. & Nanotechnology

Imaging

Computational Bioengineering

TRADITIONAL HOUSE CALL

Photo from the 1962 Boston University Hub Yearbook

CAN WE AFFORD THIS?

- Other
- Medicaid
- Medicare
- Private

Data from Centers for Medicare and Medicaid Services; Historical from 1965-2004; Projected from 2005-2015; Medicaid includes Federal, State, & Local
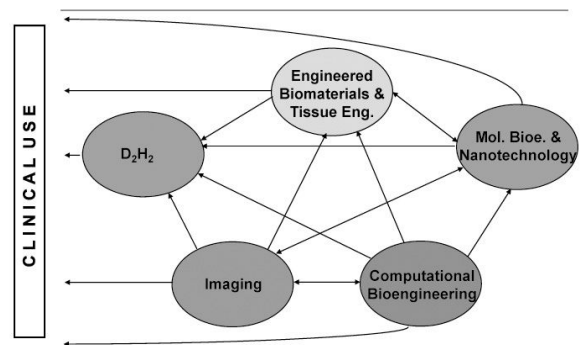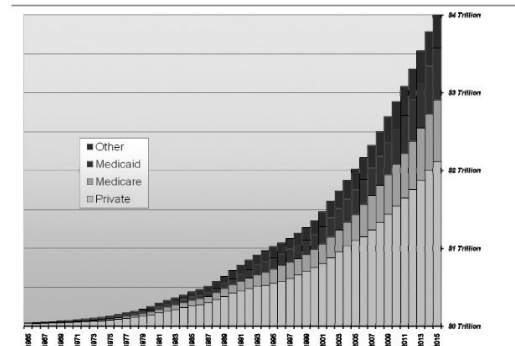
CRISIS IN HEALTHCARE

Aging Population
- Average life expectancy has increased from 47.3 in 1900 to 77.8 in 2004
- Oldest of the over 70 million baby boomers in the US became 60 years old in 2006

Lack of Accessibility
- Nearly 45 million Americans are uninsured and roughly half of all patients in the US do not get the recommended care for their illness
- These populations tend to only seek care in emergency situations, or when their conditions worsen

D_2H_2 (Distributed Diagnosis and Home Healthcare)

Where the patient is

Wearable or implanted instrumentation

Clinics and Hospitals

Other Specialists and Clinicians

Home, nursing home, work or battlefield

Intelligent Controller

INTERNET

Databases/ Applications/ Web Server

Emergency Room

Physiological sensors incl. home ultrasound

Primary Care Provider

2-way audio/video link

Assay modules   Handheld station

PATIENT-CENTERED MEDICINE

- Purpose
  - Engage patients in their own health care
  - Improve quality of care and patient outcomes
  - Increase productivity, efficiency, and safety

- Current status
  - The healthcare system in U.S. is broken, and there is a deepening crisis with 18% of GDP
  - Healthcare is focused on diseases, treatments, drugs and doctors
  - Patients are becoming more knowledgeable about their health conditions and available treatment options

- Trends
  - Patient-owned medical record via health info technology
  - Patient as the manager and owner of their own health info
  - Home monitoring and care of chronic diseases

MICROFLUIDIC SENSOR IN A SINGLE DISPOSABLE FOR POINT-OF-CARE DIAGNOSTICS (Gates Foundation)

Micronics' 7-layer Mylar laminate hematology cartridge--*rapid prototyping and mass fabricability*

MICRONICS, INC.

WASTE CONTAINMENT AREA   HEMOGLOBIN CELL

MIXING CHAMBERS

MICROCYTOMETER

SAMPLE STORAGE

SAMPLE AND REAGENT INLETS

PHIMS DEPLOYMENT

Dec. 2004

Dec. 2002

UW Medicine
REGIONAL HEART CENTER

Jan. 2006

Mental Health

May 2007

PHIMS

DPA.org.sg
Disabled People's Association, Singapore

Ling Kwang Home, Singapore
Oct. 2005

MATERNAL CARE IN AFRICA

Provided by midwives, traditional birth attendants, family members

REDUCING MATERNAL MORTALITY

- Large discrepancy between developed and developing countries
  - Maternal Mortality Ratio (MMR): maternal deaths out of 100,000 live births
    - 17 in US
    - 2,000 in Sierra Leone
  - Lifetime risk of maternal death
    - 1 in 2,800 in developed nations
    - 1 in 16 for Sub-Saharan Africa

other 20%
severe bleeding 25%
ectopic pregnancies 7%
obstructed labor 8%
unsafe abortion 13%
infection 15%
pre-eclampsia/eclampsia 12%
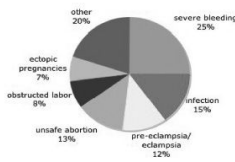
CHALLENGES IN MATERNAL HEALTHCARE

1st delay (Home)	2nd delay (Infrastructure)	3rd delay (Hospital wait)
» Non recognition of danger signs » Lack of birth preparedness by family and community	» Poor roads » Poor communication networks » Lack of transport	» Inadequate skilled attendants » Lack of equipment, drugs and supplies » Poor referral system

E-MEDICINE SOLUTION
Deployed in August 2008 in Africa

Local clinician side

Communication networks

Server and database

E-medicine
University of Washington

Clinical data

Ultrasound imaging

Blood pressure

Normal care

Global clinician side
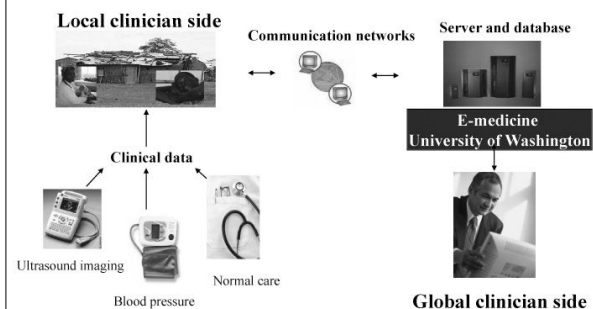
MY AGING FROM 1971 to 2001
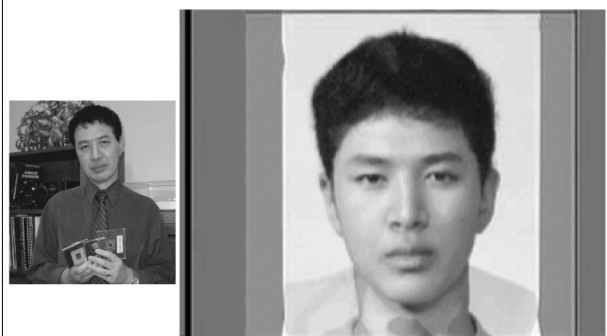
OPPORTUNITY RECOGNITION: GO AGAINST THE FLOW?

- Ultrasound processing is computationally intensive operations
  - e.g., 31.3 billion operations per second for an ultrasound back-end
- Data flow is unique and data rates are high
- Hardwired circuit boards are typically used to perform these operations
- To upgrade or deploy new applications, many of these boards may need to be modified or redesigned
  - significant R&D expense

IN SIEMENS ULTRASOUND MACHINE
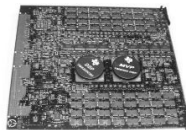
- In 1996, we developed the Programmable Ultrasound Image Processor (PUIP) using two TI TMS320C80 processors
  - Commercially known as *Crescendo*™ image processing system
- PUIP is capable of 4 billion operations per second (BOPS)
- PUIP is an integral part of the Siemens family of ultrasound systems
  - Initially integrated into the ELEGRA system.
- Enabled rapid prototyping and release of new clinically successful applications like 3D ultrasound imaging and panoramic imaging

2D SIESCAPE IMAGING

REAL-TIME 3D ULTRASOUND IMAGING
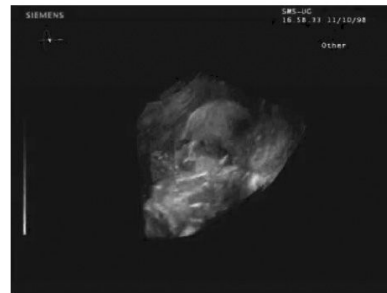
INTRODUCING NEW ULRASOUND MACHINES AT RSNA 2003

UW R&D since FEB. 2000

REAL-TIME 3D US IMAGING (2004)

BREAST EXAMINATION WITH TISSUE ELASTICITY

- Clinical Benefits
  - To visualize the tissue stiffness
  - To differentiate tumor from normal tissues
  - To increase detection rate and reduce unnecessary treatments

- Other Application Areas
  - Prostate, thyroid, and vessels …

Frame rate up to 30 fps

Invasive ductal carcinoma

Breast application

THYROID ELEASTOGRAPHY

Normal
B-mode | Strain

Papillary carcinoma
B-mode | Strain
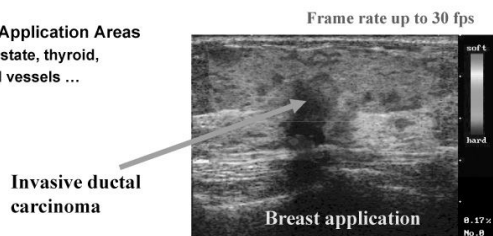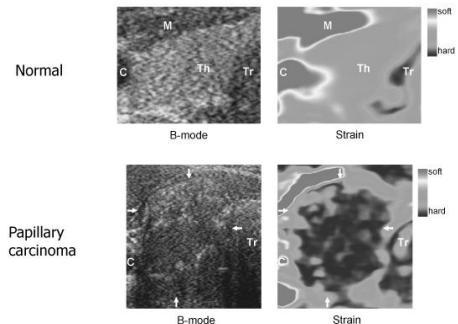
CORONARY ARTERY DISEASE (CAD) CLINICAL NEED

- Early stage detection of CAD is critical
  - 50% of men and 64% of women who died suddenly from CAD did not have symptoms prior to a fatal heart attack[1]

- Current methods for diagnosing CAD are inadequate due to low accuracy in detecting early-stage disease
  - 88% would be considered at low/moderate risk the day before their heart attack[2]
  - Sensitivity of stress ECG may be as low as 30%[1]

- Poor screening for expensive and invasive procedures
  - 20-30% of coronary angiograms are unnecessary
    - The average diagnostic angiogram costs $18,000[1]
  - Huge monetary burden
    - $400B/yr spent on heart disease, $142B/yr spent on CAD, in excess of $30B/yr spent on diagnostics[1]

1. American Heart Association (2005)
2. Association for Eradication of Heart Attacks

VIBRATIONS FROM STENOSIS

vibrations stenosis

direction of flow

Vibration amplitude image

Wall vibration spectrum
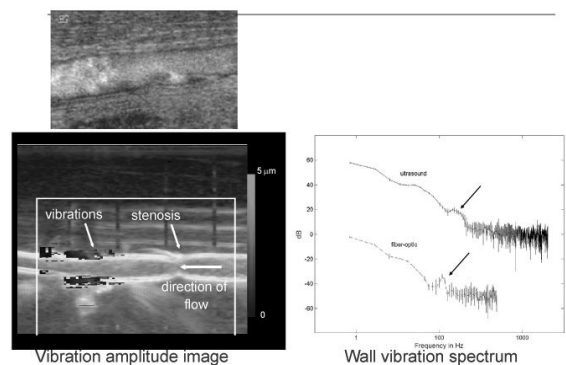
FIRST CLINICAL TISSUE VIBRATION IMAGING SYSTEM

Engineered at the University of Washington

Fully programmable in software

Hitachi HiVision 5500
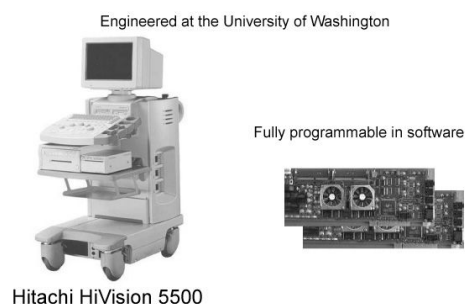
HIGH-GRADE LAD STENOSIS

Nuclear stress test was negative
Stress echo was negative

85-90% lesion in mid LAD

START-UP OR LICENSE?

Ease of use
Low cost

Phase II: CardioScreen

GP's Office
Addressable market:
$6B one-time device sales
$2B/yr recurring

Phase I: CardioMax

Cardiology
Clinics and Hospitals
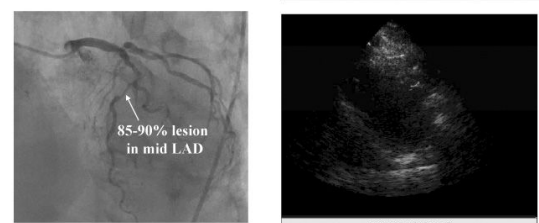
Acceptance
Time
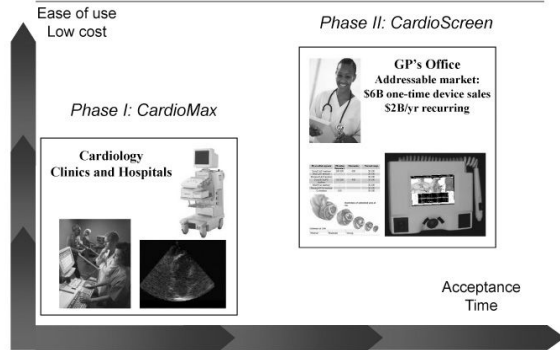
ROADMAP FOR HOME ULTRASOUND SYSTEM

Easy to use
Low cost

Further innovations
Convincing outcomes
Socioeconomic acceptance

Innovative R&D
Clinical needs

Acceptance
Time

Current users | Physician's office or visiting nurse | Patient or their family members
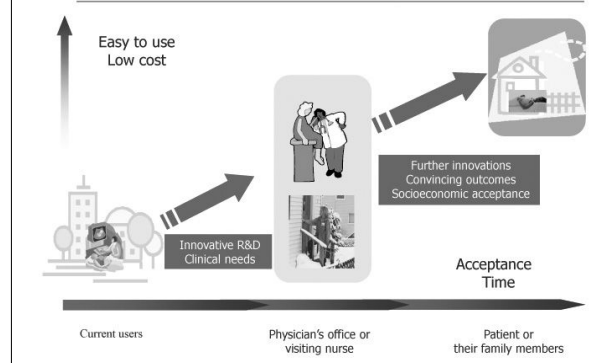
WHAT DOES IT TAKE TO SUCCEED?

- Excellence and innovation in research
- Understand the needs (marketing) and competition
- Vision, risk-taking, entrepreneurial culture, and (realistic) optimism
- Leverage the existing strengths and experience
- IP
- Passion, perseverance and patience
- Team building and planning
- Integrity, trust and fairness
- Good peoples and communications skills
- Entrepreneurial ecosystem
- Close ties with industry, win-win-win
- External research funding and external/internal translational funding

TRANSLATIONAL RESEARCH FLOW

NIH
NSF
DoD
Foundations
Industry

TGIF
RRF
WRF

Coulter

Industry
VC/Start-up
BMGF
AMI+

| Basic Research, Tech Develop | Feasibility Study, Prototyping | Preclinical Study | Product Develop | Clinical Study | Routine Clinical Use |
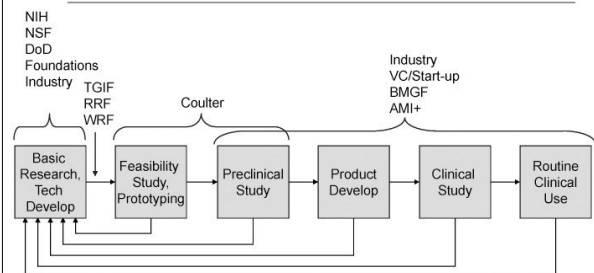
IDEAL ATTRIBUTES OF GRADUATE STUDENTS

- Honesty & Integrity
- Dedication/Passion
- Self-Motivation
- Hardworking
- Perseverance
- Innovative
- Independent Thinking
- Communication Skills
- Excel under Pressure & Ambiguity
- Confident
- Constructive

- Proactive
- Responsive & Responsible
- Unselfish
- Self-Control
- Open to Criticism
- Learn from Mistakes and Failures
- Team Player
- Interdisciplinary
- Multi-tasking
- Leadership
- Vision

IDEAL ATTRIBUTES OF FACULTY MEMBERS

- Outstanding Scholarship
- Personal and Professional Integrity
- Excellent Teacher
- Leadership
- High Energy
- Vision
- Strive for Excellence
- Communications Skills
- Able to Make Difficult Decisions
- Team Builder
- Patience
- Sensitivity
- Humility

- Selflessness
- Confidence
- Open-Minded and Open to Criticism
- Self-Motivated and Tenacious
- Multi-tasking and Multi-level
- Insightful
- Able to see a big picture
- Planning: Strategic, Financial, …
- Good recruiter
- Cheerleader and Supporter for Former Students
- Grantsmanship
- Business/Industry Relations
- Press Relations

INGREDIENTS FOR A HIGH-IMPACT ACADEMIC UNIT

- Outstanding faculty
- Well-trained future leaders in our students and postdocs
- Critical mass
- External research funding
- Research leadership and risk-taking
- IP and technology transfer
- Mutually-beneficial relationship with industry
- Excellent staff
- Excellent facilities and infrastructure
- Support from government, industry, institution and individuals
- Entrepreneurial and collaborative spirit
- Stable and innovative leadership

CONCLUSION

- Bioengineering is the fastest growing engineering discipline and the engineering discipline of the 21st century
- It takes multidisciplinary approaches with teamwork, partnership, patience, and persistence,
- There are many opportunities to transform and revolutionize future medicine and healthcare
- Although there are many pitfalls in technology commercialization, we should do it and do it better due to not only our responsibility with taxpayers' monies supporting our research, but also for benefiting humanity
- We need to contribute towards improving health, not only in the developed countries, but also in the developing countries

UNIVERSITY OF WASHINGTON

제38회
대한의용생체공학회 추계학술대회
발표논문초록

| **포스터 I** | 11월 14일, 09:30 ~ 12:50, (1층 로비) |

P1-1 청진음에서 심음의 감소를 위한 Adaptive Noise Cancellation
김일동[1], 정규혁[2], 이인성[2]
[1]충북대학교 바이오정보기술학과, [2]충북대학교 전파공학과

P1-2 자동 혈압계의 검증을 위한 커프압력 및 청진음 기록 장치의 개발
박대규[1], 지영준[1], 이종실[1], 오홍식[1], 김인영[1], 신동범[1], 김승환[2]
[1]한양대학교 의용생체공학과, [2]한국전자통신연구원

P1-3 혈압측정 알고리듬 개발을 위한 예비 시스템 구현
박성민[1], 예수영[2], 최병철[3], 전계록[1]
[1]부산대학교 의학전문대학원 의공학협동과정, [2]부산대학교 의학전문대학원 BK사업단, [3]춘해대학교 의료공학과

P1-4 계단식 감압과 단일 맥동 검출을 적용한 오실로메트릭 방법에서의 혈압측정 알고리즘
오홍식, 지영준, 이종실, 김인영, 김선일
한양대학교 의용생체공학과

P1-5 스펙트럼 분석을 이용한 마취 심도 평가지표 분류
유주연[1], 박준모[1], 예수영[2], 김태균[3], 백승완[3], 전계록[4]
[1]부산대학교 의과대학 의공학 협동과정, [2]부산대학교 의과전문대학원 BK21 사업단,
[3]부산대학교 의과대학 마취통증의학과, [4]부산대학교 의학전문대학원 의공학교실

P1-6 Hierarchical classification scheme의 변화에 따른 이상 비트 분류 성능의 비교
이도훈, 조백환, 박관수, 송수화, 이종실, 지영준, 김인영, 김선일
한양대학교 의용생체공학과

P1-7 체외생명구조장치에서 역박동 방법이 심혈관 응답에 미치는 영향에 대한 수치적 연구
임기무, 최성욱, 김인수, 전형민, 심은보
강원대학교 공과대학 기계의용공학과

P1-8 적응필터를 이용한 전원잡음 제거
조재성, 지영준, 이종실, 김인영, 김선일
한양대학교 의용생체공학과

P1-9 모바일 환경에서 휠체어용 심전도와 심탄도의 측정
한동균, 홍주현, 차은종, 이태수
충북대학교 의과대학 의공학교실

P1-10 모의 맥파 재현 장치 개발
허현, 김은근, 남기창, 허영
한국전기연구원

P1-11 u-Healthcare를 위한 착용형 생체신호계측 단말장치의 성능평가
홍주현, 차은종, 이태수
충북대학교 의과대학 의공학교실

P1-12 협착 혈류 모델을 이용한 자기 공명 위상대조영상 기반 차압측정법의 실험적 검증
방성식[1], 서지혜[1], 김태호[1], 최현우[1], 이종민[1,2]
[1]경북대학교 대학원 의용생체공학과, [2]경북대학교 의학전문대학원 영상의학교실

P1-13 맥파신호를 이용한 부침맥 정량화 알고리즘
강재환, 이혜정
한국한의학연구원 의료연구부

P1-14 디지털 PID 제어기를 이용한 X-선 투시 장치의 자동휘도조절 제어기의 구현

강학성[1,2], 조성찬[1,3], 정재업[4], 최민주[1]

[1]제주대학교 의공학협동과정, [2]삼진전자, [3](주)HnT MEDICAL, [4](주)코메드

P1-15 설태, 홍반 및 균열 탐색을 위한 설 분석 방법

김근호, 도준형, 이시우, 김종열

한국한의학연구원 의료연구부

P1-16 개인별 맞춤형 운동을 위한 생체신호 계측 단말기 개발

김동수, 심명헌, 김태균, 윤형로, 신태민

연세대학교 보건과학대학 의공학과

P1-17 기밀성이 확보된 이식형 인공중이용 음향 센서 및 액추에이터의 개발

김민우[1], 김동욱[1], 성기웅[1], 임형규[1], 정의성[1], 이장우[1], 이명원[1], 이정현[2], 김정오[3], 신동식[3], 서정[3], 조진호[1,4]

[1]경북대학교 전자전기컴퓨터학부, [2]경북대학교 의과대학 의공학교실, [3]한국기계연구원, [4]첨단 감각기능 회복장치 연구소

P1-18 3축 가속도 센서를 이용한 낙상 방향 추정 시스템

김명철[1], 예수영[2], 손정만[3], 정동근[4], 노정훈[5], 전계록[5]

[1]부산대학교 의과대학 의공학 협동과정, [2]부산대학교 의학전문대학원 BK 사업단, [3]춘해대학 의료공학과, [4]동아대학교 의공학교실, [5]부산대학교 의학전문대학원 의공학교실

P1-19 담도 스텐트의 최적화 설계

김상호, 신일균, 김성현, 이주호, 김한기, 기병윤

(주)엠아이텍 중재의학연구소

P1-20 식별 주파수 가변에 따른 경락별 반응 특성

명현석, 이경중, 이용흠

연세대학교 의공학과

P1-21 초저온 냉동고(Deep Freezer)의 원격 감시 시스템 개발

민경환, 김만기, 윤희구, 최원석, 김종순, 신동익, 허수진[1]

서울아산병원 의공학과, [1]울산대학교 의과대학 의공학교실

P1-22 편마비 환자에서 정량적 온도감각분석계로 측정한 온도감각역치 평가

배하석[1], 김성민[2], 심은결[1], 이승열[3]

[1]이화여자대학교 의학전문대학원 재활의학과, [2]건국대학교 의료생명대학 의학공학부, [3]건국대학교 신기술융합과

P1-23 운동 부하 검사 시스템 개발

심재경, 이지훈, 조경원, 김범룡, 지영준, 이종실, 김인영

한양대학교 의용생체공학과

P1-24 한국형 범용 이어쉘 개발을 위한 파라메터 추출에 관한 연구

에르덴바야르[1], 주상익[1], 전유용[1], 고민수[1,2], 길세기[1,2], 이상민[1,2]

[1]인하대학교 전자공학과, [2]인하대학교 정보전자 공동연구소

P1-25 수술실 무영등의 고장발생 감소를 위한 개선활동 소개

오주현, 윤희구, 추교진, 사은식, 김종순, 신동익[1], 허수진[1]

서울아산병원 의공학과, [1]울산대학교 의과대학 의공학교실

P1-26 최대하운동시 피부온도와 최대산소 섭취량의 관계

유재원, 김태균, 신태민

연세대학교 보건과학대학 의공학과

P1-27 고이득, 저노이즈를 가진 표면건식용 근전도 센서의 개발

육선우, 박세훈, 최기원, 홍응표, 문무성

재활공학연구소 전자제어팀

P1-28 병렬처리구조의 GPU를 이용한 초음파 빔집속

윤창한, 김태완, 서신혁, 송태경

서강대학교 전자공학과

P1-29 반원상 회전 안면 여드름 촬영 시스템과 구진 여드름 선택 알고리즘 개발

윤치열[1], 공현중[2], 민성욱[3], 서대헌[3], 김희찬[4]

[1]서울대학교 대학원 협동과정 바이오엔지니어링 전공, [2]서울대학교 대학원 협동과정 의용생체공학전공

[3]서울대학교 의과대학 피부과학교실, 서울대학교병원 여드름 연구실

[4]서울대학교 의과대학 의공학교실, 서울대학교 의학연구원 의용생체공학연구소

P1-30 비침습적 체내 경화도 측정을 위한 초음파 탄성도 측정 시스템 개발

이균정[1], 최우혁[1], 서종범[1], 최서형[2], 신태민[2]

[1]연세대학교 보건과학대학 의공학과, [2]하나한방병원

P1-31 방사선 이미지 시스템을 위한 데이터 획득 장치의 IC 개발

정진석[1,2], 황인호[1], 육선우[1], 윤문철[2]

[1]재활공학연구소 전자제어팀, [2]부경대학교 공과대학 기계공학부

P1-32 심전도실 ECG 무선 전송방식 연구 및 확장에 대한 고찰

조성범[1], 김진만[1], 진경원[1], 김종순[1], 이원구[2], 신동익[3], 허수진[3]

[1]서울아산병원 의공학과, [2]의료정보팀, [3]울산대학교 의과대학

P1-33 Mutual Infomax 기법을 이용한 보청기 궤환신호 제거

지윤상, 권세윤, 육순현, 김희평, 신동범, 김인영, 김선일

한양대학교 학과간협동과정 의용생체공학과

P1-34 Hall 센서를 이용한 요골동맥 맥파 측정시스템 구현

진상곤[1], 정지운[1], 이윤정[1], 김필운[1], 김명남[2]

[1]경북대학교 대학원 의용생체공학과, [2]경북대학교 의과대학 의공학교실

P1-35 비이식형 전기 배뇨곤란조절기의 전극 간 임피던스 변화에 따른 안전성 연구

최경무, 하용현, 한병희, 조민형, 이수열

경희대학교 전자정보대학 동서의료공학과

P1-36 요속검사시 합산평균에 의한 잡음 최소화 기법

최성수, 이인광, 김경아, 이태수, 차은종

충북대학교 의과대학 의공학교실, 충북 BIT 연구중심대학사업단

P1-37 Analog-Digital Mixed ECG ASIC의 개발과 적용

최우혁, 김태균, 신태민

연세대학교 보건과학대학 의공학과

P1-38 450kVp Tube Voltage를 이용한 X-ray 화물검색시스템 개발

황인호, 정진석, 육선우

재활공학연구소

P1-39 암밴드형 생체신호 단말기를 이용한 에너지 소비량 추정에 관한 연구

김태균, 김동수, 유재원, 최우혁, 신태민

연세대학교 보건과학대학 의공학과

P1-40 상용화된 혈당 및 체온 측정기기를 이용한 재택형 건강관리 시스템의 구현

고현철[1,2], 심 훈[1,2], 윤영로[1,2]

[1]연세대학교 보건과학대학 의공학부, [2]재택건강관리센터시스템 연구센터

P1-41 고차 통계의 Hermite 모델을 이용한 심전도 비트 분류
박관수[1], 조백환[1], 이도훈[1], 송수화[1], 이종실[1], 지영준[1], 김영수[2], 김인영[1]
[1]한양대학교 의용생체공학과, [2]한양대학교 의과대학 신경외과

P1-42 고해상도(HD) 수술 현미경 디지털 영상시스템 설계와 적용
임장혁, 문혁준, 서종모
서울대학교 공과대학 전기공학부

P1-43 분류된 심전도 비트의 클러스터링에 관한 연구
송수화[1], 조백환[1], 이도훈[1], 박관수[1], 지영준[1], 이종실[1], 김인영[1], 김영수[2]
[1]한양대학교 의용생체공학과, [2]한양대학교 의과대학 신경외과

P1-44 The Mobile Application with HL7 Protocol on uHealthcare Environment
박필준[1], 신동익[2], 허수진[1,2]
[1]서울아산병원, [2]울산대학교 의과대학

P1-45 응급 홀터 데이터를 위한 대응 시스템 개발에 관한 연구
심 훈[1,2], 노연식[1,2], 이승환[1,2], 윤형로[1,2], 윤영로[1,2]
[1]연세대학교 대학원 의공학과, [2]재택건강관리센터시스템 연구센터

P1-46 재택건강관리시스템 사용자를 위한 개인건강정보 관리 웹 사이트 모델 제시
이승환[1,2], 김효민[1,2], 윤영로[1,2], 황성오[2,3]
[1]연세대학교 보건과학대학 의용전자공학과, [2]재택건강관리센터시스템 연구센터, [3]연세대학교 원주 의과대학 응급의학과

P1-47 재택건강관리시스템 운용을 위한 효율적인 HIER(Home Healthcare Information Encoding Rule) 표준의 설계
이정훈[1], 심훈[1], 이주환[2], 윤영로[1]
[1]연세대학교 대학원 의공학과, [2]공영DBM

P1-48 음 자극 인지 훈련에 에 따른 청감 향상 및 청각 중추 가소성 연구
권세윤[1], 김희평[1], 김준식[3], 정천기[3], 홍성화[2], 김인영[1], 김선일[1]
[1]한양대학교 의용생체공학과, [2]성균관대학교 의과대학 삼성의료원 이비인후과교실,
[3]MEG 센터 서울대학교 신경외과학교실

P1-49 배양된 기관형적 해마 절편에서 NGF의 p75 수용체를 통한 신경의 활동성 증가에 대한 연구
김도형[1], 양세라[2], 지윤상[1], 송인호[1], 김인영[1], 김선일[1], 박지호[2]
[1]한양대학교 의용생체공학과, [2]경희대학교 동서의학대학원

P1-50 두개골 개방 후 수복 고정판 개발
김정래
을지대학교 보건과학대학 의료공학과

P1-51 망막신경절세포 응답신호의 정량적 분석 및 spike train decoding을 이용한 인공시각장치 자극조건 개발
류상백[1], 김경환[1], 예장희[2], 구용숙[2]
[1]연세대학교 보건과학대학 의공학과, [2]충북대학교 의과대학 생리학 교실

P1-52 Polyimide electrode에 도금된 platinum의 접착력 향상을 위한 연구
백동현[1,2], 이은중[1], 이대호[1], 박정호[2], 이상훈[1]
[1]고려대학교 보건과학대학 생체의공학과, [2]고려대학교 공과대학 전자전기공학과

P1-53 정상망막과 변성망막의 전기자극에 의한 반응 특성 비교
예장희, 구용숙
충북대학교 의과대학 생리학교실

P1-54 엔트로피 및 최우추정법을 이용한 표면 근전도 기반 손가락 동작 인식
유경진, 차갑문, 신현출
숭실대학교 IT 대학 정보통신전자공학부

P1-55 한글 및 영어 단어의 시각적 인지 시 난이도에 따른 감마대역 활성화 및 위상동기화 특성 변화
윤진, 최정우, 김자현, 김경환
연세대학교 보건과학대학 의공학과

P1-56 야간 수면 중 수면 단계 변화 예측 및 응용
김종원[1,2], 이진성[4], P. A. 로빈슨[1,2,3], 정도언[4]
[1]호주 시드니 대학교 물리학과, [2]호주 시드니 웨스트미드 병원 뇌동역학연구소,
[3]호주 시드니 대학교 의학과, [4]서울대학교병원 수면의학센터 및 신경정신과

P1-57 각성 수준에 따른 인지 능력 변화
최미현, 이행운, 이수정, 이봉수, 정순철
건국대학교 의료생명대학 의학공학부

P1-58 양자화된 순간주파수 정보에 의한 인공와우의 멜로디 인지성능 개선
최성진, 김경환
연세대학교 보건과학대학 의공학과

P1-59 뇌자도 계측에 의한 Somatosensory Cortex에서의 복수신호원 변별
김봉수[1], 정천기[1], 김준식[1], 우치카와 요시노리[2]
[1]서울대학교병원 신경외과 MEG센터, [2]동경전기대학 이공학부

P1-60 First-arrival Pulse Detection for Ultrasound Transmission Computed Tomography via Windowed Nonlinear Energy Operator
S. H. Kim[1], C. H. Kim[2], E. Savastyuk[2], and T.-S. Kim[1]
[1]Department of Biomedical Engineering, Kyung Hee University, Republic of Korea
[2]Samsung Electro-Mechanics Co. LTD., Korea

P1-61 골프 퍼팅 동작의 일관성과 성공률에 관한 연구
이성대[1,2], 김형식[1], 최진승[1], 강동원[1], 임영태[3], 탁계래[1], 이정한[1]
[1]건국대학교 의료생명대학 의학공학과, [2]건국대학교병원 의공학팀, [3]건국대학교 스포츠과학부 골프지도학과

P1-62 Temporal Fine structure가 Interaural Phase Difference 구별 능력에 미치는 영향 : Cochlear Implant simulation study
김희평, 권세윤, 지윤상, 육순현, 신동범, 김인영, 김선일
한양대학교 의용생체공학과

P1-63 Laparoscopy 기구를 이용한 봉합술의 팔 움직임에 관한 기초 연구
서영욱[1], 김광기[1], 최형석[1], 안동헌[1], 오휘빈[1], 조영호[1], 김영우[2]
[1]국립암센터 연구소 의공학연구과, [2]국립암센터 연구소 위암연구과

P1-64 다중 초점 치료 초음파의 초음파: 주요 혈관 보호를 위한 반초점
이재문[1], 서종범[2]
[1]퍼시픽 시스템, [2]연세대학교 보건과학대학 의공학과

P1-65 환청을 동반한 정신분열병 환자를 위한 가상 환청자극 노출 시스템의 개발: 타당성 파악을 위한 예비연구
신영석[1], 구정훈[1], 한기완[1], 이형래[1], 박진식[1], 박일호[2], 김재진[2], 김인영[1], 김선일[1]
[1]한양대학교 공과대학 의용생체공학과, [2]연세대학교 세브란스정신건강병원 의학행동과학연구소

P1-66 잉크젯 프린터를 이용한 박테리아 패터닝
윤성희, 이슬기, 조명옥, 김중경
국민대학교 기계·자동차공학부, 웰빙환경기술연구소

P1-67 SU-8 Shadow Mask를 이용한 마이크로 렌즈 제작
이대호[1], 백동현[1,2], 이은중[1], 박중열[1], 이상훈[1]
[1]고려대학교 보건과학대학 생체의공학과, [2]고려대학교 전자전기공학과

P1-68 광학적 특성 조절이 가능한 Poly(dimethylsiloxane)

이은중[1], 이대호[1], 백동현[1,2], 박중열[1], 이상훈[1]

[1]고려대학교 보건과학대학 생체의공학과, [2]고려대학교 전기 전자공학과

P1-69 상호작용 방법의 차이에 따른 정서인지의 차이; 뇌기능영상 연구

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

P1-70 고정된 Maxwell coil과 회전형 Helmholtz coil을 이용한 자기 추력

하용현, 최경무, 한병희, 조민형, 이수열

경희대학교 전자정보대학 동서의료공학과

포스터 II   11월 14일, 14:00 ~ 18:00, (1층 로비)

P2-1 이석기관의 이상을 진단하기 위한 PC기반의 주관적 수직 및 수평검사 시스템 (SVV&SVH)구현에 대한 고찰

김원규[1], 김현준[1], 서현원[1], 김태종[1], 권혁남[1], 김병태[1,2]

[1]삼성서울병원 의공학과, [2]성균관대학교 의과대학

P2-2 ISO13485를 적용한 초음파영상진단기기의 도플러 모드 QC

정현애[1], 조신희[1], 서기홍[1], 권혁남[1], 김병태[1,2]

[1]삼성서울병원 의공학과, [2]성균관대학교 의과대학

P2-3 마취기 Flow sensor의 정확도 유지를 위한 Risk Management

채영한[1], 김홍규[1], 이호석[1], 권혁남[1], 김병태[1,2]

[1]삼성서울병원 의공학과 , [2]성균관 대학교 의과대학

P2-4 Spin-Echo MR Imaging을 이용한 자성체의 위치 추적

강래훈, 한병희, 조민형, 이수열

경희대학교 전자정보대학 동서의료공학과

P2-5 레이저 자극이 근육세포의 증식과 유전자 발현에 미치는 영향

곽지현, 김병관, 박수지, 정병조, 김지현

연세대학교 보건과학대학 의공학과

P2-6 조영제를 이용한 Micro-CT 소동물 촬영

김규원, 최정민, 이수열, 조민형

경희대학교 전자정보대학 동서의료공학과

P2-7 턱 움직임 시뮬레이션 시스템을 이용한 하악 비대칭 운동의 동적인 분석

김대승[1], 황순정[3], 최순철[2], 이삼선[2], 허민석[2], 허경회[2], 이원진[2]

[1]서울대학교 의과대학 방사선응용생명 협동과정, 치학연구소 및 BK21

[2]서울대학교 치과대학 구강악안면방사선학교실, 치학연구소 및 BK21

[3]서울대학교 치과대학 구강악안면외과학교실, 치학 연구소 및 BK21

P2-8 기능적 EIT 영상법을 이용한 실험견 폐 내부의 공기분포 영상화

김명석, 권지현, 우응제

경희대학교 전자정보대학 동서의료공학과

P2-9 측두엽 간질 환자에서의 대뇌 피질의 두께 변화 관찰

김선형[1], 이종민[1], 태우석[2], 홍승봉[2], 김인영[1], 김선일[1]

[1]한양대학교 의용생체공학과, [2]성균관 의과대학 삼성병원 신경과

P2-10 기댓값 최대화 재구성 알고리즘을 위한 상이한 투사기-역투사기 연구

김수미[1,2], 이재성[2]

[1]서울대학교 방사선응용생명과학 협동과정, [2]핵의학교실

P2-11 MREIT 시스템을 이용한 실험견 사체 두부의 도전율 영상

김영태[1], 정우철[1], Atul S. Minhas[1], 김형중[1], 이태휘[1], 강병택[2], 박희명[2], 우응제[1]

[1]경희대학교 동서의료공학과, [2]건국대학교 수의과대학, 수의내과학교실

P2-12 Functional change of prefrontal cortex associated with semantic language processing in TLE patients after temporal lobectomy

김재훈[1], 이종민[1], 강은주[2], 조항준[1], 김치헌[3], 김준식[3], 송인찬[4], 정천기[3], 김선일[1]

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P2-13 정상인 남녀 종아리의 MREIT 도전율 영상

김형중[1], 김영태[1], 정우철[1], Atul S. Minhas[1], 우응제[1], 권오정[2]

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P2-14 최소 침습형 레이저 프로브 시스템 개발

류연항, 이용흠, 손태윤, 강희성, 윤진희, 배영우, 정병조

연세대학교 보건과학대학 의공학부

P2-15 침술과정 및 효과에 대한 전기적 해석

류연항[1], 정병조[1,2], 이용흠[1,2]

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P2-16 병렬 연산을 이용한 이미지 재구성의 속도향상

박민재, 이재성, 김수미, 이동수, 박광석

서울대학교 협동과정 의공학교실, 서울대학교 의과대학 핵의학교실

P2-17 혈관성 장애 환자의 자기공명 뇌영상의 비정상적 명암 측정 및 국부적 분포의 자동 분석에 관한 연구

박준성[1], 이종민[1], 구방본[1], 서상원[2], 나덕렬[2], 김인영[1], 김선일[1]

[1]한양대학교 의용생체공학과, [2]성균관대학교 삼성서울병원 신경과

P2-18 고강도 집속초음파 적용 영역의 온도변화 측정 시뮬레이션

백은솔, 서종범

연세대학교 보건과학대학 의공학과

P2-19 펄스 반전 칼라 플로우 영상을 위한 대역 선택적 회귀 필터를 이용한 클러터 제거 기법

손왕영, 이재진, 강현, 송태경

서강대학교 전자공학과

P2-20 치료용 근접 방사선원의 실시간 위치 판별을 위한 유기 섬광 광섬유 집합체 센서의 제작

신상훈[1], 조동현[1], 장경원[1], 유욱재[1], 서정기[1], 이봉수[1], 문주현[2]

[1]건국대학교 의료생명대학 의학공학부, 의공학 실용기술 연구소, [2]동국대학교 에너지·환경대학 에너지·환경시스템학부

P2-21 디지털 맘모그래피 영상에서 미소석회질 검출에 관한 연구

오휘빈, 김영재, 김광기, 최형석, 서영욱, 안동현, 조영호

국립암센터 기초과학연구부 의공학 연구과

P2-22 실버 핼라이드 광섬유를 이용한 고주파 열치료용 비접촉식 온도측정 어레이 센서

유욱재, 서정기, 조동현, 장경원, 신상훈, 이봉수

건국대학교 의료생명대학 의학공학부, 의공학 실용기술 연구소

P2-23 MR 영상을 이용한 20대, 40대 정상 한국인의 안구 부피 계측
이수정[1], 최미현[1], 탁계래[1], 이법이[2], 정순철[1]
[1]건국대학교 의학공학부, [2]건국대학교 해부학교실

P2-24 치과임플란트용 수술네비게이션 시스템
이우진[1], 이원진[2], 김대승[1], 허민석[2], 이삼선[2], 최순철[2], 허경회[2]
[1]서울대학교 의과대학 협동과정 방사선응용생명과학, [2]서울대학교 치과대학 구강악안면방사선학

P2-25 단위 영상 중첩 방법을 이용한 합성 구경 집속 시스템의 구현
이재영[1], 이재근[2]
[1]삼성 SDI, [2]연세대학교 의과 대학

P2-26 다주파수 시간차 EIT 영상법을 이용한 소화 기능의 영상화
이재웅, 권지현, 구환, 우응제
경희대학교 동서의료공학과

P2-27 정상인 뇌 에서 대뇌 피질 구조와 뇌의 크기와의 관계
임기호, 이종민, 김선형, 김선일
한양대학교 의용생체공학부

P2-28 색정보를 이용한 복강경 수술도구 분할
임혜원[1], 박준우[1], 김광기[1], 김영우[2], 조영호[1]
[1]국립암센터 기초실용화연구부 의공학연구과, [2]국립암센터 위암연구과

P2-29 KHU Mark1 EIT 시스템을 이용한 목의 시간차 영상획득 기초실험
정선윤, 권지현, 우응제
경희대학교 전자정보대학 동서의료공학과

P2-30 모폴로지를 이용한 맥락막 혈관 영상 강조
정지운[1], 김필운[1], 이윤정[1], 신재필[2], 조진호[3], 김명남[3]
[1]경북대학교 대학원 의용생체공학과, [2]경북대학교 의과대학 안과학교실, [3]경북대학교 의과대학 의공학교실

P2-31 고에너지 X-선 조사에 의한 광섬유 방사선량계와 EBT film의 심부선량 백분율 측정 및 비교
조동현[1], 장경원[1], 유욱재[1], 신상훈[1], 서정기[1], 이봉수[1], 조효성[2], 김 신[3]
[1]건국대학교 의료생명대학 의학공학부, [2]연세대학교 보건과학대학 방사선학과, [3]제주대학교 에너지공학과

P2-32 부분 영역의 고해상 뇌기능자기공명 영상처리를 위한 대뇌피질 모델기반의 분석방법
조항준, 이종민, 김재훈, 임기호, 김인영, 김선일
한양대학교 의과대학 의공학교실

P2-33 랜덤포레스트를 이용한 미세석회화의 통계적 판별에 대한 연구
최형석, 김광기, 오휘빈, 서영욱, 안동현, 조영호
국립암센터 기초과학연구부 의공학연구과

P2-34 Conductivity Imaging of Postmortem Canine Abdomen using 3T MREIT System
Atul S. Minhas[1], 김영태[1], 정우철[1], 김형중[1], 이태휘[1], 강병택[2], 박희명[2], 우응제[1]
[1]경희대학교 동서의료공학과, [2]건국대학교 수의과대학 수의내과학교실

P2-35 Validation of Convex Nonquadratic Spline Priors for Bayesian Limited Angle Tomography Reconstruction
Van-Giang Nguyen, Soo-Jin Lee
배재대학교 전자공학과

P2-36 신경 활동에 따른 반사율 변화를 이용한 광섬유 기반의 신경 신호 검출
이종환[1], 김정훈[2], 김성준[1,2]
[1]서울대학교 자연과학대학 협동과정 뇌과학전공, [2]서울대학교 공과대학 전기컴퓨터공학부

P2-37 발 압력 신호를 이용한 파킨슨 환자 보행의 인식

전효선[1], 한종희[1], 이원진[2], 전범석[3], 박광석[4]
[1]서울대학교 협동과정 바이오엔지니어링 전공, [2]서울대학교 치과대학 방사선학과,
[3]서울대학교 의과대학 신경과, [4]서울대학교 의과대학 의공학과

P2-38 금속 나노선 물질에 따른 표면 플라즈몬 공명 바이오센서의 감도 향상 특성

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P2-39 나노선이 적용된 표면 플라즈몬 공명 바이오센서에서 반응 물질의 결합 위치에 따른 감도 특성 연구

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P2-40 트레드밀에서의 에너지 소비량을 예측하기 위한 3축 가속도계와 신체정보를 이용한 다중회귀분석

강동원, 최진승, 문경률, 이정환, 정순철, 탁계래
건국대학교 의학공학부

P2-41 능동 족관절 보조기 착용 유무에 따른 노인의 족저굴곡 토크 보조

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

P2-42 반복적인 유체전단응력에 반응하는 뼈세포의 섬모체에 대한 연구

김병관, 곽지현, 권이석, 김지현
연세대학교 보건과학대학 의공학과

P2-43 골절방지 시스템의 개발을 위한 낙상 시뮬레이션의 충돌면 계수에 관한 연구

김성현[1], 김용욱[2], 김동욱[3,4], 김남균[3]
[1]전북대학교 대학원 의용생체공학과, [2]전북대학교 헬스케어 기술개발 사업단,
[3]전북대학교 공과대학 바이오메티컬공학부, [4]고령친화 복지기기 연구센터

P2-44 젊은층 대비, 한국인 고령층의 맨발 보행시 족저압 특성 분석

문종필[1], 유창훈[1], 최진승[2], 강동원[2], 주종필[3], 탁계래[2], 이성재[1]
[1]인제대학교 의용공학과, [2]건국대학교 의학공학부, [3]보스산업

P2-45 쇄골 재건 고정판의 디자인과 기계적 성질

박상수[1], 최성훈[1], 박상수[2,3]
[1]을지대학교 의료공학과, [2]전북대학교 바이오나노시스템공학과, [3]트라디메딕스 의료기기 연구소

P2-46 Characteristics in Frequency Domain of Postural Sway of Elderly Adults Participating in the Training for Postural Control

박용군[1], 오가영[2], 권대규[3,4], 김정자[3], 김동욱[3], 김남균[3]
[1]전북대학교 의용생체공학과, [2]전북대학교 헬스케어공학과, [3]전북대학교 바이오메디칼공학부, [4]고령친화복지기기연구센터

P2-47 고령자의 골절방지를 위한 휴대형 낙상 감지 시스템

박진[1], 김용욱[2], 김동욱[3,4], 김남균[3]
[1]전북대학교 대학원 헬스케어공학과, [2]전북대학교 헬스케어 기술 개발 사업단,
[3]전북대학교 공과대학 바이오메디컬공학부, [4]전북대학교 고령친화 복지기기 연구센터

P2-48 보청기에 마이크로폰 어레이를 이용한 시간과 주파수영역에서의 잡음제거

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

P2-49 뇌졸중 회복 향상을 위한 웹 기반의 무선 뇌 신경 자극 시스템 개발

소성석[1], 양윤석[2], 유문호[2,3], 김남균[2]
[1]전북대학교 대학원 헬스케어공학과, [2]전북대학교 공과대학 바이오메디컬공학부, [3]전북대학교 고령친화복지기기연구센터

P2-50 트레드밀 운동 시 체질량 지수(Body Mass Index)에 따른 에너지 소모도 차이 비교
손량희[1], 최희석[1], 임도형[2], 김영호[1,2]
[1]연세대학교 의공학과, [2]연세의료공학연구원

P2-51 직립 자세에서 지지면의 수평진동에 따른 동적 자세 응답
오가영[1], 박용군[2], 권대규[3,4], 김정자[3], 김동욱[3], 김남균[3]
[1]전북대학교 대학원 헬스케어공학과, [2]전북대학교 대학원 의용생체공학과,
[3]전북대학교 공과대학 바이오메디컬공학부, [4]전북대학교 고령친화복지기기연구센터

P2-52 기립상태에서 발바닥 진동자극의 주파수에 따른 자세균형 응답
유미[1], 김정자[2,3], 김동욱[2], 김남균[2]
[1]전북대학교 대학원 의용생체공학과, [2]전북대학교 공과대학 바이오메디컬공학부, [3]전북대학교 고령친화복지기기연구센터

P2-53 하지에 인가한 전기 자극이 신체동요에 미치는 영향
이선연[1], 유 미[2], 김동욱[3,4], 김남균[3]
[1]전북대학교 대학원 헬스케어공학과, [2]전북대학교 대학원 의용생체공학과
[3]전북대학교 공과대학 바이오메디컬공학부, [4]전북대학교 고령친화복지기기연구센터

P2-54 직립자세동안 전정기관 전기자극이 인가되었을 때 신체동요에 대한 영향
이아름[1], 유 미[2] 김정자[3,4], 김동욱[3], 김남균[3]
[1]전북대학교 대학원 헬스케어공학과, [2]전북대학교 대학원 의용생체공학과
[3]전북대학교 공과대학 바이오메디컬공학부, [4]전북대학교 고령친화 복지기기 연구센터

P2-55 RFID 기반의 전자페그보드를 이용한 유비쿼터스 원격재활 시스템
정다영[1], 유문호[2,3], 양윤석[2], 김남균[2]
[1]전북대학교 공과대학 헬스케어공학과, [2]전북대학교 공과대학 바이오메디컬 공학부, [3]고령친화복지기기연구센터

P2-56 가상현실을 이용한 시각적 피드백제어를 통한 편마비환자의 자기수용감각 이용하는 reaching movement훈련의 효과
조상우[1], 구정훈[1], 강윤주[2], 조윤경[3], 추연지[3], 임수정[3], 이수미[3], 김인영[1], 김선일[1]
[1]한양대학교 의용생체공학과, [2]을지병원 재활의학과, [3]노원 을지병원

P2-57 밴드 가변형 난청시뮬레이터 개발에 관한 연구
주상익[1], 강현덕[1], 전유용[1], 고민수[1], 길세기[1,2], 이상민[1,2]
[1]인하대학교 전자공학과, [2]인하대학교 정보전자 공동연구소

P2-58 고령자용 신발 평가를 위한 고령자 보행 특성에 대한 기초 연구
최진승, 강동원, 문경률, 탁계래
건국대학교 의학공학부

P2-59 보행재활을 위한 동적균형 훈련이 가능한 양측 대칭형 보행 훈련기기 개발
조용석[1], 허용도[1], 태기식[2], 이현주[3]
[1]건양대학교 전자정보공학과, [2]건양대학교 의공학과, [3]안동과학대학 물리치료과

P2-60 편마비 환자의 보행 시작시 총 압력중심 변화
황선홍, 박선우, 최희석, 김영호
연세대학교 보건과학대학 의공학부

P2-61 한국 고령자의 일상생활 중 다양한 높이에서의 STS(sit-to-stand) 시 관절운동 특성 분석
황성재, 손종상, 김정윤, 김현동, 임도형, 김영호
연세대학교 의공학과, 연세의료공학연구원

P2-62 3차원 해면골에 배양된 조골세포의 Oscillatory Fluid Flow induced Shear Stress와 Cyclic Mechanical Strain에 대한 영향 연구
김병관, 곽지현, 김지현
연세대학교 보건과학대학 의공학과

P2-63 재주조한 치과용 Ni-Cr 및 Co-Cr 합금의 부식거동
양정호[1], 권태엽[1,2], 김교한[1,2]
[1]경북대학교 의용생체공학과, [2]경북대학교 치의학전문대학원 치과생체재료학교실

P2-64 온열치료온도(42℃)와 체온(37℃) 조건에서 Paclitaxel의 농도 변화에 따른 CRL1888 마우스 종양 세포의 Survival rate에 관한 연구
황은미[1], 추현욱[1], 최성민[2], 조현설[3], 김영곤[1]
[1]인제대학교 의용공학과, [2]부산가톨릭 대학교 치기공학과, [3]광양보건대학 물리치료학과

P2-65 MRS를 이용한 근육유래줄기세포의 지방분화유도시 세포 대사물질 변화에 대한 기초 연구
천송이[1], 김태형[1], Tan Kee Chin[1], 최민영[2], 조지현[4], 홍관수[4], 신정욱[1], 정옥찬[1], 양영일[2,3], 문치웅[1]
[1]인제대학교 의용공학과, [2]인제대학교 백인제기념임상의학연구소,
[3]인제대학교 의과대학 병리학교실, [4]한국기초과학지원연구원 오창분소

P2-66 MR 온열치료를 위한 coaxial-slot antenna 가열코일의 컴퓨터 모의실험 및 온도 측정
김태형[1], K.C.Tan[1], 천송이[1], 최기승[1], 이광식[2], 은충기[2], 문치웅[1]
[1]인제대학교 의용공학과, [2]인제대학교 부산백병원 영상의학과

P2-67 Micro-CT에서 x-ray grid가 image quality에 미치는 효과
최정민, 김규원, 이수열, 조민형
경희대학교 전자정보대학 동서의료공학과

P2-68 직류 모터 제어를 통한 자기공명영상용 대동맥형 맥동 혈류 모델의 제작
방성식[1], 서지혜[1], 김태호[1], 최현우[1], 이종민[1,2]
[1]경북대학교 대학원 의용생체공학과, [2]경북대학교 의학전문대학원 영상의학교실,

학생논문경연   11월 14일, 15:00 ~ 18:00, B (608호)

S-1 고속 광 스펙트럼을 이용한 뇌조직 신경 활동 측정
이종환[1], 김성준[1,2]
[1]서울대학교 자연과학대학 협동과정 뇌과학전공, [2]서울대학교 공과대학 전기컴퓨터공학부

S-2 완화된 배열 부분집합 정칙화에 의한 컴프턴 카메라 재구성의 완화파라미터 특성
이미노, Van-Giang Nguyen, 이수진
배재대학교 전자공학과

S-3 레이저 파장에 따른 지방용해 효과에 관한 연구
강인혜, 김수정, 박하나, 신은정, 여민아, 이연의, 윤종인
대구가톨릭대학교 보건과학대학 의공학과

S-4 적응 윈도우를 사용한 Laser Speckle Contast Analysis(LASCA)
진호영, 신현출
숭실대학교 IT대학 정보통신학과

S-5 약물에 의한 간질 유발시 마우스 뇌에서 근적외선 분광법과 뇌전도의 동시측정
이승덕[1], 고달권[1], 이민아[2], 김법민[1], 최지현[2]
[1]연세대학교 의공학과, [2]한국과학기술연구원 신경과학센터

S-6 Micro-CT 영상에서 Fuzzy Algorithms을 사용한 Bone Parameters 측정
무하마드아부요수프, 최정민, 조민형, 이수열
경희대학교 동서의료공학과

S-7   자기 공명 위상 대조 영상기반의 유속 측정과 벽면 전단 응력 측정의 검증

         김태호[1], 서지혜[1], 방성식[1], 최현우[1], 이종민[2]

         [1]경북대학교 대학원 의용생체공학과, [2]경북대학교 의학전문대학원 영상의학교실

S-8   Preliminary Study on the Novel MR Thermal Mapping using Self-developed Phase Unwrapping Method

         Tan Kee Chin[1], 김태형[1], 천송이[1], 최기승[1], 이광식[2], 신운재[3], 은충기[4], 전제량[4], 문치웅,[1]

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

S-9   생체신호 기반의 틸팅 열차 승차감 평가 방법 연구

         이영범[1], 신광수[1], 송용수[2], 한성호[2], 이명호[1]

         [1]연세대학교, [2]한국철도기술연구원

S-10   편마비 환자를 위한 상지 재활훈련시스템 개발

         손종상[1], 손량희[1], 김정윤[1], 황성재[1], 임도형[2], 김영호[1,2]

         [1]연세대학교 의공학부, [2]연세대학교 의료공학연구원

포스터 Ⅰ

청진음에서 심음의 감소를 위한 Adaptive Noise Cancellation

김일동[1], 정규혁[2], 이인성[2]
[1]충북대학교 바이오정보기술학과, [2]충북대학교 전파공학과

Adaptive Noise Cancellation for Heart Sound Reduction in Phonocardiograms

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[1]Dept of Bioinformaticstechnology, Chungbuk University, [2]Dept of Radio, Chungbuk University

Abstract

Least mean squares(LMS) adaptive noise cancellation(ANC) and recursive least squares (RLS) ANC are applied and compared for heart sound (HS) reduction from phonocardiogram (PCG). We adopt the RLS adaptive segmentation method to analysis heart sound location required in ANC scheme. Power Spectral density (PSD) for qualitative evaluation of any method for HS reducing from PCG were assessed in original, filtered, and analyzed signals. The results show that RLS-ANC is better than LMS-ANC.

자동 혈압계의 검증을 위한 커프압력 및 청진음 기록 장치의 개발

박대규[1], 지영준[1], 이종실[1], 오홍식[1], 김인영[1], 신동범[1], 김승환[2]
[1]한양대학교 의용생체공학과, [2]한국전자통신연구원

Recording System of Cuff Pressure and Auscultation Sound for NIBP Validation

D. K. Park[1], Y. J. Chee[1], J. S. Lee[1], H. S. Oh[1], I. Y. Kim[1], D. F. Shen[1], S. H. Kim[2]
[1]Department of biomedical engineering, Hanyang University, [2]Electronics and Telecommunications Research Institute

Abstract

The gold standard method of NIBP(Non-invasive Blood Pressure) measurement is the observer's manual assessment of Korotkoff sound. To improve the assessment algorithm in automatic blood pressure measurement devices, we need to assess SBP(Systolic Blood Pressure) and DBP(Diastolic Blood Pressure) as reference value. To assess these value while recording is not easy because of the observers may give different values in many cases. So the recording of Korotkoff sound and cuff pressure is valuable for assessment in later.

We developed the recording system which is consisted of cuff, microphone, amplifier. It enables to collect various data from subjects. After collecting the data, the browsing software can playback the recorded sound and pressure variation in computer. The recording system records the Korotkoff sound faithfully. The sound can be played with sound card in PC. The cuff pressure also displayed with Korotkoff sound on the same time. With this playback software, the observer can assess SBP (Systolic Blood Pressure) and DBP (Diastolic Blood Pressure).

The digital recording system of Sphygmomanometry can be used for validating of blood pressure measurement devices, and data collection of oscillometric method and education.

혈압측정 알고리듬 개발을 위한 예비 시스템 구현

박성민[1], 예수영[2], 최병철[3], 전계록[1]

[1]부산대학교 의학전문대학원 의공학협동과정, [2]부산대학교 의학전문대학원 BK사업단, [3]춘해대학교 의료공학과

System for a Blood Pressure Measurement Algorithm Development

S.M.Park[1], S.Y.Ye[2], B.C.Choi[3], G.R.Jeon[1]

[1]Department of Biomedical Engineering, College of Medicine, Pusan National University
[2]BK21 Medical Science Education Center, College of Medicine, Pusan National University
[3]Department of Biomedical Engineering, College of Medicine, Choon Hae University

Abstract

In this paper, we present the preliminary system for a blood pressure measurment algorithm development using a new method. This system includes amplifier, ADC, CPU and motor. We can set the measurement of range of systolic and diastolic pressure. Also we can set pressure steps and step delay time. The GUI in PC shows step waves. We can select five step delay times that are consist of from 1 to 5 sec. Maximum cuff pressure is 200mmHg but result shows waves only measurement ranges that we set. This system's measurement method is depression measurement - an air-motor run until the highest pressure and the cuff pressure depress 2mmHg(setting value) per step. The graph is showed only systolic and diastolic range's data that we want.

계단식 감압과 단일 맥동 검출을 적용한 오실로메트릭 방법에서의 혈압측정 알고리즘

오홍식, 지영준, 이종실, 김인영, 김선일
한양대학교 의용생체공학과

BP Measurement algorithm based on the oscillometric method and The Single Peak Detection, using a controlled step deflation technique

H. S. Oh, Y. J. Chee, J. S. Lee, I. Y. Kim, S. I. Kim
Dept of Biomedical Engineering, Hanyang University

Abstract

Oscillometry is the one of non-invasive blood pressure measurement techniques, which is most widely used for automatic devices due to its simplicity. In this study, we suggest the modified step deflation which one of the deflation type of oscillometry to reduce the measurement time while keeping the advantage of step deflation over linear deflation at general oscillometry. We implemented the blood pressure measurement system and new algorithm for control of the solenoid valve and realtime signal processing. We measure the amplitude of each systolic pulsation. For the validation of our suggested method, human observer assessed SBP/DBP according to EHS (European Hypertension Society) guideline.

스펙트럼 분석을 이용한 마취 심도 평가지표 분류

유주연[1], 박준모[1], 예수영[2], 김태균[3], 백승완[3], 전계록[4]
[1]부산대학교 의과대학 의공학 협동과정, [2]부산대학교 의과전문대학원 BK21 사업단,
[3]부산대학교 의과대학 마취통증의학과, [4]부산대학교 의학전문대학원 의공학교실

Classification for the Evaluation Index of an Anesthesia Depth using the spectrum Analysis

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[2]BK21 Medical Science Education Center, College of Medicine, Pusan National University
[3]Department of Anesthesia, College of Medicine, Pusan National University
[4]Department of Biomedical Engineering, College of Medicine, Pusan National University

Abstract

In order to detect and measure the brain activity variation under different depth of anesthesia, the power spectral density (PSD) of electroencephalogram (EEG) of the was studied in this paper. The spectral edge frequency (SEF), alpha-delta ratio(ADR), alpha-theta ratio(ATR), beta-delta ratio (BDR), beta-theta ratio (BTR), delta-theta ratio(DTR) and theta-delta(TDR) of EEG were calculated by PSD under different DOA and the DOA was analyzed. Among the parameters, SEF, BDR, BTR is significant. The BDR and BTR of EEG were decreased significantly at induction state compare with pre-operation state. During the operation, these parameters remain low value. At awaked state, these parameters were increased.

The study shows that BDR and BTR are useful parameters to estimate the depth of anesthesia. The classifier decide the decision of anesthesia or awaked states.

Hierarchical classification scheme의 변화에 따른 이상 비트 분류 성능의 비교

이도훈, 조백환, 박관수, 송수화, 이종실, 지영준, 김인영, 김선일
한양대학교 의용생체공학과

Abnormal beat classification performance results with different hierarchical classification scheme

D. H. Lee, B. H. Cho, K. S. Park, S. H. Song, J. S. Lee, Y. J. Chee, I. Y. Kim, S. I. Kim
Dept. of Biomedical Engineering, Hanyang University

Abstract

In multi class classification problem, it is very important to consider that the unbalanced data distribution.

To solve this problem, in our previous study, the hierarchical classification model with 2 stages on domain knowledge have been constructed. We could obtained better performance than previous studies.

In this paper, the other hierarchical classification models using 21 features are validated for arrhythmia abnormal beat detection. Those models compare with our previous hierarchical model based on domain knowledge.

In conclusion, the results proves that our domain knowledge based hierarchical classification is useful to the ECG beat classification with unbalanced data distribution.

체외생명구조장치에서 역박동 방법이 심혈관 응답에 미치는 영향에 대한 수치적 연구

임기무, 최성욱, 김인수, 전형민, 심은보
강원대학교 공과대학 기계의용공학과

Numerical Study of Effect of Counter-pulsation on Cardiovascular Response in the ECLS treatment

K. M. Lim, S. W. Choi, I. S. Kim, H. M. Jun, E. B. Shim
Department of Mechanics and Biomedical Engineering, Kangwon National University

Abstract

Extracorporeal Life support (ECLS) system is the device used in emergency cases to substitute a extracorporeal circulation in open heart surgery, cardiac arrest or in acute cardiopulmonary failure. To obtain the effect of counter-pulsation on hemodynamic response in the ECLS quantitatively, we developed cardiovascular model which consists of 12 compartment model of heldt et al. and 3 compartment model of Schreiner et al. based on windkessel approximation. We compared coronary perfusion, arterial pulse pressure, cardiac output, and left ventricular pressure-volume diagram according to flow configuration such as counterpulsation, copulsation, and continous flow. When counter-pulsation was applied, 5% higher coronary perfusion, 26% lower pulse pressure, and 2% higher cardiac output than co-pulsation condition were calculated. We conclude that counter-pulsation configuration in the ECLS is hemodynamically more stable than co-pulsation and influences the positive effect to recover ventricles.

적응필터를 이용한 전원잡음 제거

조재성, 지영준, 이종실, 김인영, 김선일
한양대학교 의용생체공학과

Power-line Interference Removal using Adaptive filter

J.S. Cho, Y.J. Chee, J.S. Lee, I.Y. Kim, S.I. Kim
Department of Biomedical Engineering, College of Engineering, Hanyang University

Abstract

We proposed the removing method of power-line interference of ECG signal through the output signal of DRL(Driven right leg) circuit and adaptive filter.

Although the DRL circuit eliminate the power-line interference, power-line noise may appear because of the non-ideal characteristics of active and passive components.

The output signal of DRL still contains power-line and other noisy components. And notch filter isn't applicable to remove the power-line interference because the frequency of the power-line noise is not always stable at exactly 60Hz(or 50Hz). Therefore we used the output signal of DRL as a reference signal for adaptive filter to eliminate power-line noise[1].

모바일 환경에서 휠체어용 심전도와 심탄도의 측정

한동균, 홍주현, 차은종, 이태수

충북대학교 의과대학 의공학교실

ECG and BCG Monitoring on Wheelchair for Mobile Environment

D. K. Han, J. H. Hong, E. J. Cha, T. S. Lee

Department of Biomedical Engineering, College of Medicine, Chungbuk University

Abstract

The purpose of this study is to measure both ECG and BCG(Ballistocariograph) signal of a subject on moving or resting wheelchair and detect the heart rate and respiratory rate and transmit an event message to remote server on emergent situation. To acquire ECG and BCG data, amplifier circuits were composed to be suitable for their characteristics. The output signals were converted to digital data and stored in BCG and ECG signal archiving media (SD card). CDMA module was used to transmit the event data on ECG electrode detachment and the received data was monitored by the developed C# application program. 8 volunteers participated in the experiment to evaluate the validity of the developed device. When the event occurs in each subject, 48 Kbyte data, stored for 32 seconds from that point, was transmitted to remote server through CDMA cellular phone network correctly. The received data of ECG, BCG, and 3-axial acceleration could be archived in server and the heart rate and respiratory rate could be measured and analyzed. The correlation coefficients of respiratory rate in resting and moving with the real value were 0.9636 and 0.9237, respectively. The correlation coefficient of R-R intervals between the developed and reference device was 0.999. In conclusion, the developed device in this study could acquire the ECG and BCG data of subjects on wheelchair simultaneously and measure their heart rate and respiratory rate. In addition, event data was verified to be transmitted to remote server without any errors. This system is expected to be usable for the mobile healthcare system.

모의 맥파 재현 장치 개발

허현, 김은근, 남기창, 허영

한국전기연구원

Radial Artery Pulse Wave Simulator using a Linear Motor

H. Heo, E. G. Kim, K. C. Nam, and Y. Huh

Korea Electrotechnology Research Institute

Abstract

To reproduce radial artery pulse wave, electronic simulator was developed. The microprocessor regenerates arterial pulse waveform based on the measured human arterial pulse data. Also, users could make arbitrary pulse wave by controlling the amplitude and time information. The radial artery pulse wave could be generated from magnetic force using a linear motor. It was also confirmed that developed pulse simulator generated adaptive amplitude depend on the applied pressure on the surface of actuator. It is also necessary to update and extend pulse wave database for many cases and symptoms.

u-Healthcare를 위한 착용형 생체신호계측 단말장치의 성능평가

홍주현, 차은종, 이태수

충북대학교 의과대학 의공학교실

Performance Evaluation of Wearable Biomedical Signal Measurement Terminal for u-Healthcare

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 network and inform remote doctor in emergent situation. It consists of three parts, such as, biomedical signal acquisition, data recording, and transmission part. Three experiments were performed to evaluate the accuracy, reliability and operability, applicability during daily life of the developed device. First, ECG signals were measured using the developed device and commercial reference device during sitting and cycling 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 seven types of motion in daily life, the accuracy of data transmission to remote server using CDMA network was verified on two types of event occurring. Last, SMS message function was tested. By acquiring and comparing subject's biomedical signal and motion signal, the accuracy, reliability and operability, applicability during daily life of the developed device were verified. Therefore, the developed system is expected to play an important role in constructing the domestic ubiquitous healthcare system in the near future.

협착 혈류 모델을 이용한 자기 공명 위상대조영상 기반 차압측정법의 실험적 검증

방성식[1], 서지혜[1], 김태호[1], 최현우[1], 이종민[1,2]

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In vitro Verification of MR phase-contrast based pressure gradient measurement at stenotic flow model

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Abstract

Pressure gradients across the aortic valve due to stenosis of the valve must be measured accurately to evaluate the functional severity of the stenosis. The purpose of this study was determine the feasibility of velocity-encoded phase contrast MR for estimating pressure gradients across the stenosis area in stenotic aorta model. We used velocity-encoded phase contrast MR measure flow velocity. The pressure gradient ($\triangle P$) was estimated form the simplified Bernoulli equation by using the mean velocity in stenosis area. The Pressure gradients correlated with gradients measured by using digital manometer. Correlation coefficients R^2 were over 0.91. We conclude that pressure gradient from Bernoulli equation by using the mean velocity in stenosis area reflected physical pressure gradient.

맥파신호를 이용한 부침맥 정량화 알고리즘

강재환, 이혜정
한국한의학연구원 의료연구부

Algorithm for the quantification of the floating/sinking pulse on the radial pulse wave signal

J. H. Kang, H. J. Lee
Department of Medical Research, Korea Institute of Oriental Medicine

Abstract

Pulse diagnosis is the basic method of oriental medicine diagnosis. But it is not easy to quantify the various shapes of radial pulse and to make an standardized diagnosis of patient status. In this study, we focused on the floating/sinking pulse among the typical 28 types of radial pulse and proposed a new algorithm to quantify the degree of floating/sinking pulse. This algorithm is composed of two steps: the first step is time-domain signal processing for input pulses and the second step is quantitative analysis method using the resultant scores of the first step, directly proportional to the ratio of hold-down pressure versus pulse pressure. In order for the verification of the algorithm, we took 129 normal subjects with age group 20-60 years for measurement and compared the result of algorithm with the doctor's clinical checkup for the floating/sinking pulses. Consequently, the result of the algorithm is statistically correlated with the diagnosis of the oriental medical doctor by floating pulse (3.08±1.923), middle pulse (4.63±2.275) and sinking pulse (6.91±2.279) and we hope that it will provide the diagnostic potentiality for oriental pulse feeling from radial pulse wave signal.

디지털 PID 제어기를 이용한 X-선 투시 장치의 자동휘도조절 제어기의 구현

강학성[1,2], 조성찬[1,3], 정재업[4], 최민주[1]
[1]제주대학교 의공학협동과정, [2]삼진전자, [3](주)HnT MEDICAL, [4](주)코메드

Construction of the automatic brightness controller of an x-ray image intensifier system using a digital PID controller

H. S. Kang[1,2], S. C. Jo[1,3], J. U. Jeoung[4] and M. J. Choi[1]
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[2]SamJin Electronics Ltd., [3]Hnt Medical Co., Ltd, [4]Comed Medical System Co., Ltd

Abstract

A real-time C-arm x-ray fluoroscopy system converts the x-ray which is transmitted through the human body into an image using an image intensifier and displays the image on the monitor using a CCD camera. Automatic brightness controller (ABC) detects the brightness signals of the CCD camera and controls x-ray power. ABC is the latest technology for optimizing images with minimum dose. The existing method using feedback signals in each C-arm sampling time has problems. The brightness signal detected from a CCD camera is processed by the x-ray control system. This process delays the response time to x-ray generation, causing unnecessary dose given and image processing time longer. In this paper, we have presented an ABC system which reduces x-ray dose and image construction time, employing AVR microprocessors and a digital proportional integral derivative (PID) control method.

설태, 홍반 및 균열 탐색을 위한 설 분석 방법

김근호, 도준형, 이시우, 김종열

한국한의학연구원 의료연구부

Tongue Analysis Methods for Detecting Tongue Furs, Red Spots and Cracks

K. H. Kim, J.-H. Do, S. W. Lee, and J. Y. Kim

Department of Medical Research, Korea Institute of Oriental Medicine

Abstract

The method of a tongue diagnosis is not only convenient but also non-invasive and widely used. To develop an automatic tongue diagnosis system for an objective and standardized diagnosis, the detection of coatings, spots and cracks is inevitable but difficult since the colors of tongue furs and body are similar. The proposed classification method decomposes the color components of the region into hue, saturation and brightness, resulting in classifying the regions of tongue furs(coatings) into kinds of coatings and substance and segmenting them. In addition, spots are detected by using local maxima and the variation of saturation, and cracks are searched by using local minima and the directivity of low gray values. The results illustrate the accurate discrimination of coatings and the precise detection of spots and cracks. The proposed methods can be applied to an u-Healthcare system as well as a home care system.

개인별 맞춤형 운동을 위한 생체신호 계측 단말기 개발

김동수, 심명헌, 김태균, 윤형로, 신태민

연세대학교 보건과학대학 의공학과

Development of Bio-signal Measurement System for Customized Exercise

D. S. Kim, M. H. Sim, T. K. Kim, H. R. Yoon, T. M. Shin

Department of Biomedical Engineering, College of Health Science, Yonsei University

Abstract

In this paper, we implemented exercise module that is possible to feedback of bio-signal to user. It consists of bio-signal measurement part, wireless communication part, data store part, display part and MP3 player part for feedback. ECG(electrocardiogram), PPG(photoplethysmogram), body temperature and acceleration signals were measured through bio-signal measurement part. Measured bio-signals were transmitted wirelessly by Zigbee and also stored in micro SD card using FAT32 file system. MP3 player part provides music for user and alerts a danger to user when bio-signal includes disorder. Bio-signal measurement system which was developed in this study could be useful for sports medicine and applicable to home healthcare system.

기밀성이 확보된 이식형 인공중이용 음향 센서 및 액추에이터의 개발

김민우[1], 김동욱[1], 성기웅[1], 임형규[1], 정의성[1], 이장우[1], 이명원[1], 이정현[2], 김정오[3], 신동식[3], 서정[3], 조진호[1,4]

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Development of the Acoustic Sensor and Actuator with Hermeticity for Fully Implantable Middle Ear Hearing Device

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Abstract

Several types of implatable middle ear hearing devices(IMEHDs) have been developed to overcome the disadvantage of the conventional hearing aids. IMEHDs are divided into three parts which are a microphne as an acoustic sensor, a signal processing unit, and a vibration transducer as an actuator.

In particulary, the acoustic sensor and actuator must be sealed hermetically because all of the components are implanted in human body for fully implantable middle ear hearing device(F-IMEHD).

In this paper, the acoustic sensor and actuator are implemented for F-IMEHD so that they can be properly operated for implantation periods in the human body. The hermeticity of the implemented sensor and actuator is verified by helium leak test.

3축 가속도 센서를 이용한 낙상 방향 추정 시스템

김명철[1], 예수영[2], 손정만[3], 정동근[4], 노정훈[5], 전계록[5]

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[4]동아대학교 의공학교실, [5]부산대학교 의학전문대학원 의공학교실

Developed system of fall down direction estimation using a trial-axial accelerometer

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Abstract

The aged are faced with increasing risk for falls. The aged have the easily fragile bones than others. When falls have occurred, it is important to detect this emergency state because such events often lead to more serious illness or even death. The system, for detection of emergency situation, was developed using 3-axis accelerometer in this paper as follows. The signals were acquired from the 3-axis accelerometer, and then transmitted to the PC through USB module. This system can classify the human activity, and also detect the emergency state like falls. The our study was performed to detect the correct direction of fall. The output of acceleration signal was compared and evaluated by changing a various posture after attaching a 3-axis accelerometer module on the waist. The newly developed system has some important features such as portability and convenience. One of the main advantages of this system is that it is available at home healthcare environment. The implemented system can detect the fall directions such as Front, Back, Left and Right accurately, so will be widely used in emergency situation.

담도 스텐트의 최적화 설계

김상호, 신일균, 김성현, 이주호, 김한기, 기병윤

(주)엠아이텍 중재의학연구소

The Optimization Design of Biliary Stent

S. H. Kim, I. G. Shin, S. H. Kim, H. K. Kim, B. Y. Ki

Institute of Interventional Medicine, M.I.Tech Co., Ltd.

Abstract

Biliary Stents are used to keep bile duct open after expansion which a catheter and prevent the expanded bile duct from collapsing. The most important feature of a stent is its sufficient capability for sufficient vessel scaffolding as well as its deliver-ability to the stenotic site, that is, high radial force and flexibility which are contrary to each other. In this paper, finite element analyses are utilized to evaluate these conflicting requirements. Finite element analyses for the stent system were performed using 3-D modeling (CATIA V5 R12) and structural analysis program (COSMOSWorks). In this study is suggested that a new numerical methods to test the flexibility of stent. Moreover, this paper shows how the finite element analysis can be effectively organized in the stent development.

식별 주파수 가변에 따른 경락별 반응 특성

명현석, 이경중, 이용흠

연세대학교 의공학과

The Characteristics of Meridian Response by Change of Discrimination Frequency

H. S. Myoung, K. J. Lee, Y. H. Lee

Department of Biomedical Engineering, College of Health Sciences, Yonsei University

Abstract

The aim of this paper is to suggest that optimal frequency for detecting each meridian is different. We assume that characteristics of frequency for each internal organ is different because of difference in it's structure and function. For this, we designed acupuncture point discrimination system with SPAC (Single-Power Alternative Current) stimulus pattern, and we measured left-right Ho-ku (LI4) and Zusanli (ST36) of each subject. We put a mark on acupuncture point after discrimination, and settled 8 spots around it as a Control-Point. Comparing with difference between acupuncture point and non-acupuncture point, we continued to examine as changing the frequency (3kHz, 4kHz, 5kHz). All subjects are total 9 person(male:5, female:4) and all 20's. The results can be summarized as followings.
1. Hap-Koc (LI4) : The biggest difference between acupuncture point and non-acupuncture point was found at the 4kHz.
2. Chok-Sam-Li (ST36) : 3kHz was measured as an ideal frequency.
The above results showed the possibilities that there exist optimal frequency for detecting each meridian as mentioned before.

초저온 냉동고(Deep Freezer)의 원격 감시 시스템 개발

민경환, 김만기, 윤희구, 최원석, 김종순, 신동익, 허수진[1]

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Remote Monitoring System of Deep Freezer

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Department of Biomedical Engineering, Asan Medical Center, [1]University of Ulsan College of Medicine

Abstract

This study is about remote temperature monitoring system of deep freezer which is used for storing critical biologic samples.

We measured the temperature of several deep freezers which were made by different manufactures using the same temperature sensor.

We processed these results and displayed it on PC monitor using LabVIEW. software.

With our remote monitoring system, we can make proper action for the abnormal temperature.

Moreover, if we acquire the historical data and analyze them, the condition-based maintenance(CBM) of the deep freezer will be possible.

편마비 환자에서 정량적 온도감각분석계로 측정한 온도감각역치 평가

배하석[1], 김성민[2], 심은결[1], 이승열[3]

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Evaluation of Thermal Sensory Thresholds in Hemiplegic Patients Using Quantitative Sensory Test

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Abstract

In this paper, Hemiplegic patients with unilateral cerebral lesions suffer from sensory deficit as well as motor deficit. But clinical assessment of thermal sensation is one of the least reliable components of neurological examination and is difficult to quantify. We measured thermal sensory thresholds of cold sense, warm sense, cold pain and hot pain in hemiplegic patients with thermal sensory analyzer (TSA). To investigate and quantify the thermal sensory deficit of hemiplegic patients, we compared the measurements with normal controls, between body regions, and between hemiplegic and sound side. Hemiplegic patients showed impaired thermal sensory thresholds in all modalities compared to their sound side and normal controls. Quantitative sensory test using thermal sensory analyzer can be useful to quantify the thermal sensory deficit and follow up the progress.

운동 부하 검사 시스템 개발

심재경, 이지훈, 조경원, 김범룡, 지영준, 이종실, 김인영

한양대학교 의용생체공학과

Development of Cardiopulmonary Exercise Test System

J. K. Sim, J. H. Lee, K. W. Cho, B. R. Kim, Y. J. Chee, J. S. Lee, I. Y. Kim

Department of Biomedical Engineering, Hanyang University

Abstract

In this paper, we present the development of the cardiopulmonary exercise test(CPET) system. In CPET system, we measure ventilation, concentration of oxygen and carbon dioxide in breath by breath, and ECG(electrocardiogram). Also we measure NIBP (Non-invasive Blood Pressure) and oxygen saturation(SpO_2). We controlled the treadmill increasingly according to the protocols that are used in convention.

From these data, we developed the algorithms to extract valuable information of physiological response to the physical stress. From ECG, heart rate and ST level are calculated in real time. From the data about respiration, flow rate(VE, L/min), oxygen uptaken(VO_2, L/min), CO_2 production(VCO_2, L/min) are calculated.

Also the automatic detection of anaerobic threshold(AT) was implemented using the regression technique.

This article is the report of the development of CPET, that is the first in Korea as far as we know.

한국형 범용 이어쉘 개발을 위한 파라메터 추출에 관한 연구

에르덴바야르[1], 주상익[1], 전유용[1], 고민수[1,2], 길세기[1,2], 이상민[1,2]

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A Study on Common Ear Impression for Korean Hearing aids

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Abstract

We are interested in the ready made hearing aid. It is not needed to make an hearing aid for the each people. The user can choose among ready made products so that it has an advantage of saving money and time. So in this paper, we implemented to find common impression for the hearing aid. The common impression is acquired from common things obtained from Korean ear impression models. The technology which we use is capable of comparing 3D impression in detail. It would be expected that we can get a common ear impression.

수술실 무영등의 고장발생 감소를 위한 개선활동 소개

오주현, 윤희구, 추교진, 사은식, 김종순, 신동익[1], 허수진[1]

서울아산병원 의공학과, [1]울산대학교 의과대학 의공학교실

Introduction in improvement actions to reduce problems of operating light

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Department of Biomedical Engineering, Asan Medical Center, [1]University of Ulsan, College of Medicine

Abstract

There are many kinds of medical devices (anesthesia machine, operating light, operating table, ESU, etc) for operating patient in medical center. It is necessary to quick countermeasure that medical device has a defect during surgical operation.

Most of medical device has backup device to prevent time delay during surgical operation. But operating light can not be replacedwith other backup operating light because of it's ceiling type.

So our medical center has designed periodically preventive maintenance method and used improved repair part to reduce failures. It is expected that our management method will reduce the defection and finally guarantee the efficient operating light.

최대하운동시 피부온도와 최대산소 섭취량의 관계

유재원, 김태균, 신태민

연세대학교 보건과학대학 의공학과

The relationship between skin temperature and $\dot{V}O_{2max}$ during submaximal exercise

J. W. Yu, T. K. Kim, T. M. Shin

Department of Biomedical Engineering, College of Health Science, Yonsei University

Abstract

The purpose of this study was to investigate the correlation of temperature variability and $\dot{V}O_{2max}$ during submaximal exercise. The subjects for the study were seventeen healthy male volunteers.

We used modified Bruce protocol which increases the gradient with speed according to the time. Skin temperature was measured at the forearm on a treadmill during submaximal exercise. It was sending a computer using a bluetooth module.

The correlation of temperature variability and $\dot{V}O_{2max}$ was high (r=.624) and significant (p < .05) as a result. But there was a low correlation between temperature variability and fixed factors such as individual age, height, weight, BMI, BodyFat, etc..

고이득, 저노이즈를 가진 표면건식용 근전도 센서의 개발

육선우, 박세훈, 최기원, 홍응표, 문무성

재활공학연구소 전자제어팀

Development of Surface EMG Sensor with High Gain and Low Noise

S. W. Yuk, S. H. Park, G. W. Choi, E. P. Hong, M. S. Mun

Electronics and Cotrol Lab, Korea Orthopedics and Rehabilitation Engineering Center

Abstract

This paper proposed a compact-sized surface EMG sensor with high gain and low noise. The sensor was composed of a skin interface and circuits mounted on a single package. Moreover, it has multi-stage gain amplifier and a few analog filters. The main performances of this sensor are the following : the gain is adjustable from 2,000 to 100,000 folds by external passive component, the dominant frequency is $90\sim330Hz$ with 60Hz-rejection frequency, CMRR and phase margins is above 100dB and 75°, respectively. The noise has 47uVrms at 100Hz-dominant frequency range. And, it has a dimension of $24mm\times5mm\times0.7mm$ excluding protrusions. The complete dimensions of a finished product with sensor case measured $26mm\times17mm\times10mm$ and weighed a mere 4.2g including 3-point surface electrode.

병렬처리구조의 GPU를 이용한 초음파 빔집속

윤창한, 김태완, 서신혁, 송태경

서강대학교 전자공학과

Ultrasound Beamforming Using a GPU with Massively Parallel Processing Architecture

C.H. Yoon, T. W. Kim, S. S. Seo, T. K Song

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Abstract

This paper presents an effective software structure and parallel signal processing algorithms for implementing a medica ultrasound beamformer, using a GPU with MPP(Massively Parallel Processing) architecture. The beamforming process is modified in a SIMD manner suitable for the GPU's massively parallel processing architecture. The experimental results show that the receive beamforming can be performed in 17.3 milliseconds using a single GPU when the sampling frequency is 40MHz, the view depth is 20cm, the number of scanlines per frame is 128 and the number of beamforming channels is 64.

반원상 회전 안면 여드름 촬영 시스템과 구진 여드름 선택 알고리즘 개발

윤치열[1], 공현중[2], 민성욱[3], 서대헌[3], 김희찬[4]
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Development of Face Acne Capturing System Using Semicircular Rotating Camera and Papule Detecting Algorithm

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Abstract

Acne vulgaris is a chronic and common inflammatory disease of the pilosebaceous unit. For continuous and effective skin care, computerized acne photographic systems are commonly used. But the systems do not provide screening for the entire face. To overcome this drawback, we devised a Face Acne Capturing System. Acquired images have shown that inflammatory acne regions were properly detected after color space conversion, channel selection, K-means clustering, binarization methods , and morphological operations. By comparing the result with the manual counting by a dermatologist, the proposed system achieves reliability in analyzing acne.

비침습적 체내 경화도 측정을 위한 초음파 탄성도 측정 시스템 개발

이균정[1], 최우혁[1], 서종범[1], 최서형[2], 신태민[2]
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Development of the elasticity measurement system used ultrasound for the internal stiffness measurement non-invasively

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Abstract

We have developed the non-invasive elastic measurement system used ultrasound and made plastic phantoms which were mixed plastic hardener and softener as ratio 10%···50%. We compared the elastic measurement result of the Micro Indenter and designed system for each phantom. In the result, elasticity was measured as difference 0.007MPa for each phantom. So, designed ultrasound elasticity measurement system is available to measure the elasticity.

방사선 이미지 시스템을 위한 데이터 획득 장치의 IC 개발

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IC of Readout Electronics for Radiation Imaging System

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Abstract

Recently the need for a higher level of integration in x-ray sensor systems has lead to several approaches of integrating read out electronics in a monolithic integrated circuit (IC). Typically these ICs are limited in their application to a specific problem. The IC has 16 parallel signal channels with, signal polarity control for use with either electron or hole collection from detectors. The input amplifier is optimized for a detector capacitance of 6pF, but may be used with detector capacitances up to 50pF. The peaking time of the shaper is digitally selectable, for optimum noise filtering, with peaking times geometrically spaced from 400ns to 6μs. Up to 8-IC ASICs may be daisy chained together to make a system with 128detector channels. The design was fabricated in standard 0.35um CMOS technology and the circuit occupies an area of $4 \times 4mm^2$ and dissipates 2mW per channel from a 3.3V single power supply.

심전도실 ECG 무선 전송방식 연구 및 확장에 대한 고찰

조성범[1], 김진만[1], 진경원[1], 김종순[1], 이원구[2], 신동익[3], 허수진[3]

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Development of Wireless ECG Data Transmission Method in ECG ROOM.

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Abstract

Currently, in patient data , PACS(Picture archiving system) and EMR(Electronic medical record) system has large portion in general hospitals. ECG datause LAN(local area network) in ECG Room. We draw improvement method development of ECG Data Wireless transmission method of ECG Room. It improve operator's convenience and reduce data transmission time in Wireless room environment. It is expected to get a better result with data transmission mobile device in hospital.

Mutual Infomax 기법을 이용한 보청기 궤환신호 제거

지윤상, 권세윤, 육순현, 김희평, 신동범, 김인영, 김선일

한양대학교 학과간협동과정 의용생체공학과

Feedback cancellation for hearing aid using mutual infomax

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Abstract

Feedback cancellation algorithms have been implemented in digital hearing aids to provide listening comfort and to enhance the acoustic conditions. In this paper, we proposed a nonlinear feedback cancellation algorithm based on mutual infomax algorithm in independent component analysis (ICA) for digital hearing aid. Computer simulations were performed using recorded real speech and speech shaped noise which was generated from zero-mean white gaussian noise passed through a 16th pole AR filter. Simulation results showed that the mutual infomax algorithm using high-order statistics provides better feedback cancelling performance with Laplacian distribution signal than conventional methods.

Hall 센서를 이용한 요골동맥 맥파 측정시스템 구현

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Implementation of the radial artery pulse measurement system using Hall effect sensor

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Abstract

This paper presents the ECG (electrocardiogram) sensor detecting heart rate among biological signals and the PPG (Photoplethysmography) sensor. However, these sensors have a problem of irregular detection on account of electric impedance on the skin contact area and disturbance by light. To resolve this problem, it measured radial pulse waves using the Hall effect element. Moreover, in order to measure the pulse waves more stably and linearly, it also used TMS320F2812, one of the Digital Signal Process chips so as to realize a portable wireless network (Zig-Bee) radial pulse wave measurement system.

비이식형 전기 배뇨곤란조절기의 전극 간 임피던스 변화에 따른 안전성 연구

최경무, 하용현, 한병희, 조민형, 이수열

경희대학교 전자정보대학 동서의료공학과

Safety Study of Non-implanted Electrical Urinary Incontinence Treatment Device with Impedance Changes between Electrodes

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Abstract

Nonimplanted electrical therapeutic devices of urinary incontinence strengthen the pelvic floor muscles through the conducting current into the tissues which are in contact with the stimulating electrodes. The impedance between the electrodes has an effect on the performance of the therapeutic device and the safety of patient as excessive current may flow into the contact tissues. In this study, the impedance between the stimulating electrodes have been measured with changing the distance between electrodes in the NaCl solution mimicking the human tissue in order to consider the safety.

요속검사시 합산평균에 의한 잡음 최소화 기법

최성수, 이인광, 김경아, 이태수, 차은종

충북대학교 의과대학 의공학교실, 충북 BIT 연구중심대학사업단

Measurement noise minimization by ensemble averaging in uroflowmetry

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Abstract

Uroflowmetry is a widely applied and convenient clinical test to screen the benign prostatic hyperplasia(BPH) common in aged men. A load cell is located beneath the urine container to measure the weight of urine. This standard technique is, however, sensitive to the impact applied on the bottom of the container by the urine stream, which could be a noise source lowering reliability of the test. The present study proposed a noise reduction technique by ensemble averaging the weight signals acquired from 3 load cells forming a regular triangle beneath the urine container. Simulated urination experiment demonstrated significant noise reduction by the present technique.

Analog-Digital Mixed ECG ASIC의 개발과 적용

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Development and application of the Analog-Digital mixed ECG ASIC

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Abstract

The ECG (Electrocardiographic) measurement system is difficult to maintain the stability of a system, because of being composed of many analog and digital circuit components. Accordingly, ASIC about the ECG device is necessary.

For the reason, it was developed the Analog-Digital mixed ECG ASIC. If any ECG device is applied to a standard of control, the ECG ASIC is easy to coincide with the rules of international recommendations in a point of hardware. So, the system which is applied the ECG ASIC has many good points such as miniaturization, standardization and maintenance of stability.

In this paper, the lavatory-typed ECG monitoring system is developed using the ECG ASIC. That system is comprised of three parts. One is the digital control part which manages ECG ASIC. Another is the data acquisition part which get the ECG signals from the toilet seat. The other is the part that display the ECG data to acquire by the ECG ASIC.

The developed ECG monitoring system has the characteristics of miniaturization, standardization and it is more secure than the existing system. Consequently, we identified that developed ECG Therefore, ECG ASIC can be applied to any existing ECG monitoring system more likely to be easy and secure.

450kVp Tube Voltage를 이용한 X-ray 화물검색시스템 개발

황인호, 정진석, 육선우

재활공학연구소

Development of X-ray Cargo Inspection System Using 450kVp Tube Voltage

I. H. Hwang, J. S. Jung, S. W. Yuk

Korea Orthopedics and Rehabilitation Engineering Center

Abstract

Transillumination system using radiation is widely applied to medical and industrial imaging system. In this study, I have built a linear detector array with scintillator and pin diode, and a multi-channel data acquisition system for Cargo Inspection System. The detector module consists of 16 CdWO4 crystal scintillator purchased and photodiode array designed by KAIST team. Dual switched integrator amplifier was used as transimpedance amplifier. 16 bit ADC was for digitization. The control sequence for data acquisition, MUX and 16 bit ADC is coded with VHDL(Very High Speed Integrated Circuit Hardware Description Language) and implemented on FPGA(Field Programmable Gate Array), FLEX10K. The master board with FLEX10K separately developed to handle large number of arrays. 32 bit DIO(Digital Input/Output) PCI interface card was used for data transfer. From the acquired data, the images are reconstructed for Non-Destructive Test(NDT) as well as for CT application. The gain of preamplifier was 140dB. The Signal-to-Noise(SNR) and dynamic range of the data acquisition system were measured under irradiation of the visible light by LED. The noise of pin diode and data acquisition system was $122\mu Vrss$, and the dynamic range was 92dB. The detector and data acquisition system was applied to CT and NDT, images were successfully acquired and reconstructed. The total system further need to be analyzed such DQE of each system. The developed photodiode showed comparable response to other commercially available photodiodes. The electronic noise of the data acquisition system is relatively low compared to quantum noise. Many parameters are yet to be measured and analyzed, however, fine details of the phantom were depicted for both application, CT and NDT. The channel and image was acquired on iron container(4m×16m) which contains several objects through real time data transfer. The linear X-ray scanning system can be a applied the many fields of the medical and industry.

암밴드형 생체신호 단말기를 이용한 에너지 소비량 추정에 관한 연구

김태균, 김동수, 유재원, 최우혁, 신태민

연세대학교 보건과학대학 의공학과

Prediction of energy expenditure using armband-type biosignal module during exercise

T. K. Kim, D. S. Kim, J. W. Yu, W. H. Choi, T. M. Shin

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Abstract

In this paper, we purpose suggestion of more accurate and simple estimation method to assume the energy expenditure using armband-type biosignal module during exercise. So, we put subjects' elements like a weight, a tall, a BMI, an exercise duration time for measure of convenience, and accelerometers. Subjects are 17 adult men who were healthy and not ill medically. Our experiment was performed at a treadmill using the Modified Bruce protocol. And we proceeded with the accelerometers signals acquisition of the armband-type module from humerus place of subjects' body as well as the energy expenditure using respiratory gas analysis during submaximal exercise. Consequently, accelerometer data of humerus area, weight and the exercise duration time were determined with the final parameters for the regression analysis. And the regression analysis for the estimation of energy expenditure was performed by using the SPSS 15.0. As a result, it confirms statistically effective that R is 0.967 and R square is 0.935.

상용화된 혈당 및 체온 측정기기를 이용한 재택형 건강관리 시스템의 구현

고현철[1,2], 심 훈[1,2], 윤영로[1,2]

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A Implementation of Home Healthcare Management System Using Blood Glucose Test Meter and Thermometer.

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Abstract

Recently, the Ubiquitous technology seems to march forward at a relentless, accelerating pace with health care system. Also, it is popularized about specificity and easy to use.

In this paper, we design a home health care system using commercial tools about blood glucose test meter and thermometer. And these data send off to server in the hospital using Smartphone.

고차 통계의 Hermite 모델을 이용한 심전도 비트 분류

박관수[1], 조백환[1], 이도훈[1], 송수화[1], 이종실[1], 지영준[1], 김영수[2], 김인영[1]
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Electrocardiogram beat classification using the Hermite model of the higher order statistics

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Abstract

The QRS complex is the most important wave in the ECG waveform to interpret and decide whether the heart belongs to the healthy sinus rhythm or to the specific class of arrhythmia. For the QRS complex recognition, the higher order statistics and the Hermite basis function are good characterization methods for waveform signals. In this study, we apply the higher order statistics, the Hermite basis function and the Hermite model of the higher order statistics to extract features from the QRS complex. For beat classification, we used MIT-BIH Arrhythmia Database, dividing into two datasets. The first dataset was used for training and validation, and the second for testing. When we evaluated the performance of the multiclass classification scheme using support vector machine (SVM). The results represented that the Hermite model of the higher order statistics method showed the best performance, compared to the higher order statistics and Hermite basis function methods.

고해상도(HD) 수술 현미경 디지털 영상시스템 설계와 적용

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서울대학교 공과대학 전기공학부

Design and Application of Digital HD Operation Image System

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Abstract

High Definition (HD) image system is adapted in many fields that require high resolution, and microscopic surgical image system is one of the good candidate for that application. However, expensive and poorly customized devices for medical use prevent adopting HD system in the medical imaging system. Standard definition (SD: 720×480) image system is currently in use, but the resolution is insufficient to capture the delicate microscopic operation.

In this paper, we design a HD(High Definition) digital microscopic image system which supports 1440×1080 pixels of motion image. This system can be adapted to both Leica and Zeiss microscopes, and to any cameras including bayonet mount, c-mount, and 27/35/38mm mount. In order for this, we designed adapters that satisfy required optical resolution and compatibility.

분류된 심전도 비트의 클러스터링에 관한 연구

송수화[1], 조백환[1], 이도훈[1], 박관수[1], 지영준[1], 이종실[1], 김인영[1], 김영수[2]
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A study on clustering the classified ECG heart beat

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Abstract

There have been a number of researches on automatic arrhythmia detection and classification. However, those methods always have some errors, and these should be corrected manually in the final diagnosis by physicians. Hence, this study suggests an efficient tool that aids physicians to correct the inaccurately classified beats by sub-grouping the classified heartbeats once again automatically. Firstly, we extracted 21 features based on RR interval and the morphology from MIT-BIH Arrhythmia dataset. Then we applied the K-means clustering method to the labeled ECG beat data. The clustering results with labeled data showed over 95% of accuracies and over 85% of mean sensitivity when the number of clusters reaches 200. This represents that the clustering method can be used as a part of an efficient reporting tool in an automatic arrhythmia detection system.

The Mobile Application with HL7 Protocol on uHealthcare Environment

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The Mobile Application with HL7 Protocol on uHealthcare Environment

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Abstract

Health Level Seven (HL7) is the standard of electronic data interchange in the health domain. In This paper, we have developed mobile application with HL7 protocol. This application, data are transmitted the bio-signal like SpO_2 from sensor to mobile phone through serial communication. The mobile phone convert raw data to HL7 formed data and send it to other PCs by Bluetooth or WLAN.

응급 홀터 데이터를 위한 대응 시스템 개발에 관한 연구

심 훈[1,2], 노연식[1,2], 이승환[1,2], 윤형로[1,2], 윤영로[1,2]
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The Management System for Emergency Holter ECG Data

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Abstract

In this paper, we developed the management system for Emergency Holter ECG data. It has three component of Holter ECG, Smartphone, and Holter ECG data review system. We suggest basic model of emergency Holter ECG data management in this study. The main role of this system is response to user and the doctor under emergency situation.

재택건강관리시스템 사용자를 위한 개인건강정보 관리 웹 사이트 모델 제시

이승환[1,2], 김효민[1,2], 윤영로[1,2], 황성오[2,3]
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Personal Health Information Management Web Site Modeling

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Abstract

In this paper, we present web site model for the H^2MRC(Home Health Management Research Center)'s users. In Early research, web site was established. But, H^2MRC has been modified many times and the exiting web site is not suitable for reformed H^2MRC. So, we fixes web site, and we appends new functions. This web site helps user to convenient using.

재택건강관리시스템 운용을 위한 효율적인
HIER(Home Healthcare Information Encoding Rule) 표준의 설계

이정훈[1], 심훈[1], 이주환[2], 윤영로[1]

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Design of the HIER (Home Healthcare Information Encoding Rule)
standard for the Home Healthcare Management System

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Abstract

Home healthcare management system has lots of benefits of ubiquitous healthcare area, such as mass medical services to the public, a economical price of medical services, and easy-contact medical services, wherever you are, whenever you are. However, there is not an appropriate data receive/transfer standard for this home healthcare system. In this paper, we propose the HIER (Home healthcare Information Encoding Rule) standard, that has an easy discrimination ability, an integration ability discrete data with waveform data, and an easy accessibility. The HIER standard indirectly evaluated in an example project of the H^2MRC (Home Healthcare Management System Research Center).

음 자극 인지 훈련에 에 따른 청감 향상 및 청각 중추 가소성 연구

권세윤[1], 김희평[1], 김준식[3], 정천기[3], 홍성화[2], 김인영[1], 김선일[1]

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A Study on central Auditory System Plasticity According to the Hearing Sensitivity
Enhancement Associated with Sound Intelligibility Training

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Abstract

The present study investigated the effect of the spectral-ripple discrimination training on the behavioral and cortical neurophysiological spectral-peak resolution before and after. Total ten healthy and normal hearing subjects were participate in the behavioral SR(spectral-ripple) discrimination test and MEG (magnetic encephalo -graphy) before and after four times behavioral SR discrimination training sessions over ten days. Result showed cortical neurophysiology response were significantly improved near the subtle changed stimulus as the training induced behavioral perception enhancing.

배양된 기관형적 해마 절편에서 NGF의 p75 수용체를 통한 신경의 활동성 증가에 대한 연구

김도형[1], 양세라[2], 지윤상[1], 송인호[1], 김인영[1], 김선일[1], 박지호[2]
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NGF increases synaptic activity via p75 receptor in the cultured organotypic rat hippocampal slice

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Abstract

It was investigated that the effects of NGF on synaptic plasticity in organotypic hippocampal slice using MEA system. we show that NGF rapidly increased the fEPSP activity and an increase of the activity through a p75-dependent pathway than trkA receptor. The NGF-induced activity increase occurred even in the presence of the Trk receptor blocker k252a but not p75 antibody. Furthermore, NGF unaffected long-term potentiation (LTP) in the cultured organotypic hippocampal slice. These results demonstrate that NGF-mediated neurotransmitter release in cult ured organotypic hippocampal slice is more dom inant via p75 receptor.

두개골 개방 후 수복 고정판 개발

김정래
을지대학교 보건과학대학 의료공학과

Development of a metallic plate for fixation at Femur fracture

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Abstract

This study was developed the fixation plate after operating in for in the cranial bone which the neuro surgeon should be select the device. The device's designation and sizing has a specific, known meaning that is reliable regardless of the plate by the Φ13 and Φ18. The tensile stress is 387N, and 474N. The device can be used to Ti alloy and support two port for fixation at the cranial bone.

망막신경절세포 응답신호의 정량적 분석 및 spike train decoding을 이용한 인공시각장치 자극조건 개발

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Development of stimulation pulse generation strategy for visual prosthesis by quantitative analysis and spike train decoding of retinal ganglion cell responses

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Abstract

For successful restoration of visual function by retinal implant, a method for electrical stimulation should be devised so that the evoked activities of retinal ganglion cells (RGCs) should convey sufficient information on visual input. By observing the modification of RGC responses due to the change of the stimulation parameters, it may be possible to determine optimal pulse parameters such as pulse rate, intensity, and duration for faithful transmission of visual information. To test the feasibility of this approach, we analyzed the RGC spike trains from retinal patches mounted on planar multielectrode array, evoked by temporally-patterned stimulation. Assuming that the intensity of uniform visual input is transformed to amplitudes of pulse train, we intended to determine optimal methods for the pulse amplitude modulation so that information essential for the perception of intensity variation is properly represented in the RGC responses. RGC firing rates could be modulated to track the temporal pattern of pulse amplitude variation, which implies that pulse amplitude modulation is a plausible means to enable the perception of temporal visual pattern by retinal implant. As expected, specific parameters of pulse amplitude modulation were crucial for the better encoding of visual input. Appropriate range of pulse amplitude was found so that the RGC firing rates increased monotonically according to the pulse amplitude. The similarity between the RGC firing rate and the temporal pattern of pulse intensity was the highest the pulse amplitude modulation in this range. Optimal range of pulse rate could be determined likewise.

Polyimide electrode에 도금된 platinum의 접착력 향상을 위한 연구

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Study of improving adhesion electro-plated platinum on the polyimide electrode

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Abstract

Brain Mechanical Interface (BMI) has been focused in brain-science fields. It is important to increase adhesion of platinum (Pt) for a better signaling performance of BMI since Pt can lower the interface impedance. Here, we present a method that improves adhesion of Pt on the polyimide electrodes. For this, pre-chemical (H_2SO_4 and H_2O_2) treatments and ultra-sonifications were performed under various current densities. To observe the characteristic of Pt electroplating, we tested using Atlanta Georgia solution and Marrese solution, and then SEM images were taken for visual comparison of their effects. Finally, we measured electro-plated Pt adhesion strength using adhesive tape. The method presented in this study will improve the adhesion of Pt that guarantees a lower impedance, and thus, realize high quality of EEG signal from brain.

정상망막과 변성망막의 전기자극에 의한 반응 특성 비교

예장희, 구용숙

충북대학교 의과대학 생리학교실

Comparison of Characteristics of Electrically-Evoked Responses between Normal and Degenerate Retina

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Abstract

Retinal degenerative diseases such as retinitis pigmentosa (RP) and age related macular degeneration (AMD) induce the photorecoetor degeneration. Stimulating the remaining neural network in patients retina with electrical device provides the opportunity to restore the vision. For success of the retinal prosthesis is the electrical stimuli applied through the prosthesis should be optimized. Our previous study showed that the electrical characteristics of diseased retina are different with those of normal retina. Therefore, we compared the characteristics of evoked ganglion cell response in normal and degenerate retina. rd1 mouse was used for the retinal degeneration model and C57BL/6J was used for the normal 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. 20 trains of charge balanced biphasic, anodic-first square wave current pulse without interphase delay were randomly applied at the rate of 0.25 Hz. In normal mouse retina, single peak of evoked response appeared in post stimulus histogram (PSTH). while there are multi peaks of evoked responses appeared in degenerate retina. Electrically-evoked retinal ganglion cell (RGC) response was defined as positive when it's discharge rate of $5 \sim 25$ ms in normal retina and $10 \sim 70$ ms in degenerate retina after electrical stimulus was more than twice of basal rate. The minimal threshold of charge density was 424.6 ± 200.1 (n=10 RGCs) 965.9 ± 470.2 (n=27 RGCs) $\mu C/cm^2$ in normal and degenerate mouse retina respectively (P<0.05).

엔트로피 및 최우추정법을 이용한 표면 근전도 기반 손가락 동작 인식

유경진, 차갑문, 신현출

숭실대학교 IT 대학 정보통신전자공학부

Classifying Finger Flexing Motions with Wrist Surface EMG Based on Entropy and the Maximum Likelihood Method

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Abstract

We provide a method to recognize finger flexing motions using a 4-channel surface electromyogram (sEMG). Surface EMGs are harmless to the human body and easily done. However, they do not reflect the activity of specif ic nerves or muscles, unlike invasive EMGs. On the other hand, the invasive type is difficult to use for discriminating various motions while using only a low number of electrodes. Surface EMG data in this study were obtained from four electrodes placed around the forearm. The motions we chose were the flexing of each finger (the thumb, index, middle, ring, and little fingers). One subject was trained with these motions and another left untrained. A maximum likelihood estimate was used to determine the motion of models as reconstructed from statistical properties of the data. Results showed that this method could be useful for recognizing finger motions. The average accuracy was more than 95 %

한글 및 영어 단어의 시각적 인지 시 난이도에 따른 감마대역 활성화 및 위상동기화 특성 변화

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Change of gamma-band activity and phase synchronization due to difficulty of visual recognition of Korean and English words

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Abstract

The purpose of this study was to investigate the difference and similarity in temporal brain activation patterns due to the language difference during visual perception of Korean and English words. The stimulation was visually presented as word pairs belonging to same or different categories so that N400 event-related potential (ERP) was evoked. From the spectral analysis, we found that the evoked gamma-band activity (eGBA) was significantly larger for English at ~100 ms poststimulus. The latency of the eGBA was also considerably delayed for English. Considerable phase synchronization in gamma-band (i.e., 30 - 50 Hz) was observed mostly between posterior and frontal regions along the midline at ~ 400 - 600 ms. The most apparent difference between Korean and English was observed from the phase synchronization pattern. More intense phase synchronization was observed for Korean. The difference was most evident in 200 - 400 ms, where much more electrode pairs showed significant increase in phase synchronization. Overall, the results seem to be commensurate with subjects' familiarity of each language, and the difficulty of processing words of each language.

야간 수면 중 수면 단계 변화 예측 및 응용

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Predictability of Sleep States during Nocturnal Sleep

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Abstract

Dynamical evolution of nocturnal sleep is studied using a Markovian chain model that has recently been developed to explain duration probabilities of wake and sleep states. The model parameters are determined by analyzing hypnograms of 113 obstructive sleep apnea (OSA) patients (54.0 ± 11.7 yrs., 16 female) whose polysomnographic signals were recorded twice, one without and the other with Continuous Positive Airway Pressure (CPAP) treatments. Characteristics of sleep structure of OSA patients and effects of CPAP treatment are investigated. In particular, the accuracy of predicting present sleep states using information on the past states are quantified, which shows that the predictability for apneic sleep is less than that for sleep with CPAP treatment by 6%. This result suggests a potential application value of our approach in diagnosing OSA.

각성 수준에 따른 인지 능력 변화

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Change of Cognitive Performance due to Arousal Level

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Abstract

본 연구에서는 세 가지의 arousal level이 3-back task 수행능력에 어떠한 영향을 미치는지 관찰하고자 한다. 10명의 남자 (평균 25.7 ±1.5세) 대학생과 10명의 여자 (평균 24.5 ±1.8세) 대학생이 본 실험에 참여하였다. 집단검사를 통해 추출된 사진을 이용하여 세 가지의 arousal level 즉, 긴장, 중립, 이완감정을 유발하였다. Rest1 (2분), 감성유발사진제시1 (2분), 3-back Task1 (2분), 감성유발사진 제시2 (2분), 3-back Task2 (2분), Rest2 (2분)의 6 단계로 실험이 진행되었다. 3-back task의 정답률은 중립감정일 때 가장 컸고, 이완, 긴장 감정 순서였다. 또한 통계적으로 유의하지는 않았지만 중립감정일 때 반응시간이 가장 빠른 경향을 보였다. 본 연구결과로부터 인지 처리와 무관하게 유발 된 긴장도의 증가나 감소는 과제 수행능력을 감소시킬 수 있다는 사실을 유추할 수 있다.

양자화된 순간주파수 정보에 의한 인공와우의 멜로디 인지성능 개선

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Improvement of melody recognition performance of cochlear implant by quantized instantaneous frequency information

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Abstract

We verified that a quantized instantaneous frequency (IF) information improves the melody recognition performance of cochlear implant. We used a novel method for the enhancement of melody recognition performance of cochlear implant by using a speech processing strategy incorporating instantaneous frequency (IF) encoding. For the IF extraction from incoming sound, we selected the extraction of IF using Teager energy operator (TEO), which is advantageous for its lower computational. The melody recognition performance of the proposed speech processing strategy was compared with those of a conventional strategy using envelope extraction and normal IF used strategy. Hearing tests on normal subjects using acoustic simulation and a musical contour identification task. Insignificant difference in melody recognition performance was observed between the quantized IF and the original IF encodings, as both were superior to the conventional strategy.

뇌자도 계측에 의한 Somatosensory Cortex에서의 복수신호원 변별

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Discrimination of Multiple Source Activities in Somatosensory Cortex based on a MEG Measurement

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Abstract

To discriminate multiple source activities in somatosensory area of the human cortex, we measured SEF (somatosensory evoked field) elicited by electrical stimulation to three different fingers (thumb, fourth finger, and little finger), respectively. Time-frequency analysis was also applied to the SEF data. Dominant power spectrum of the SEF by the thumb (median nerve) stimulation was different to that of the little finger (ulna nerve) stimulation (thumb: 16-18Hz, little finger: 13-15Hz). We conclude that the method, combining the time-frequency analysis and BPF with different frequency range, is useful for discriminating multiple source activities of the somatosensory area overlapping in time.

First-arrival Pulse Detection for Ultrasound Transmission Computed Tomography via Windowed Nonlinear Energy Operator

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Abstract

A windowed nonlinear energy operator (wNEO)-based algorithm is proposed to detect the first-arrival pulse of ultrasound transmission computed tomography (UTCT). In UTCT, the detection of first-arrival pulse is critical to derive imaging indices such as attenuation coefficients and time-of-flight (TOF). Currently, various algorithms utilizing threshold, maximum, wavelet, etc have been tested for the detection of the pulse, but each technique suffers from its own intrinsic properties, failing in detecting the first-arrival pulse reliably. Especially the most widely used wavelet technique, which is also considered as the most effective technique to handle frequency-dependent attenuation, dispersion, and noise of ultrasound, often fails to detect the first-arrival pulse due to the inconsistency of ultrasound pulse shapes with respect to a best mother wavelet. Furthermore, the wavelet technique is impractical for real-time processing. In this work, we propose the use of wNEO for the first time to detect the first-arrival pulse and show its outperforming results in comparison to those conventional techniques through simulation and experimental data with a pair of 5MHz ultrasound transmit/receive transducers.

골프 퍼팅 동작의 일관성과 성공률에 관한 연구

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A Study on the Correlation Between Consistency and Success Rate of Golf Putting Stroke

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Abstract

In this paper, we identified the correlation between putting consistency and success rate of golf putting stroke. The kinematic parameters for head, elbow, pelvis and knee were measured by using 3D motion analysis system (Motion Analysis Co, USA) and grip force was measured by using smart putter system during the putting stroke. The motion data was analyzed using a clustering algorithm and putting results transfor- med to numerical average values. The results shows that the elite golfers only have correlation between putting consistency and success rate.

Temporal Fine structure가 Interaural Phase Difference 구별 능력에 미치는 영향 : Cochlear Implant simulation study

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Effect of The Temporal Fine structure on the Interaural Phase Difference discrimination ability : Cochlear Implant simulation study

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Abstract

Binaural information, such as IPD(Interaural Phase Difference), ILD(Interaural Level Difference), is very important role to sound localization in normal hearing. At low frequency(<2KHz), envelope and temporal FS (fine-structure) provide an important cues to the IPD(Interaural Phase Difference) discrimination ability. Sound processing in a commercially available CI(cochlear implant), however, provide the only envelop component with modulated by periodical electrical biphasic-pulse, most of temporal fine structure information disappeared in signal processing. As a result, sound localization ability decreased in cochlear implant recipients.
In this study, we investigated the effects of temporal FS(fine-structure) on the IPD discrimination ability using the cochlear implants simulator with normal hearing participants. Our result showed that Improvement of IPD discrimination ability by increasing per of the temporal fine structure information.

Laparoscopy 기구를 이용한 봉합술의 팔 움직임에 관한 기초 연구

서영욱[1], 김광기[1], 최형석[1], 안동헌[1], 오휘빈[1], 조영호[1], 김영우[2]

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3-D hands motion analysis of a suturing using laparoscopic tools : a pilot study

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Abstract

In this paper, we propose 3D hands motion analysis factors in which a novice suturing using laparoscopic tools. We focused on the angle, IQR of wrist, elbow and shoulder of both arms. IQR(interquartile range) was reduced 47.5% that from first step 11.139 to 5th step 5.853 in the left shoulder. Also, right wrist and left elbow were reduced in 16.4%, 4.0%, respectively.

Further study is going to compare between experts and trainers motion analysis during laparoscopy surgery.

다중 초점 치료 초음파의 초음파: 주요 혈관 보호를 위한 반초점

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Advanced Multi-focusing method for HIFU: anti-focus point for major vessel protection

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Abstract

Anti-focus point was introduced for the multi-focus HIFU system and its application in the treatment was analyzed based on the linear acoustic field simulation and temperature simulation based on the bio-heat transfer equation. Anti-focus point can successfully eliminate the unexpected and undesirable focal spots formed due to the overlapped side lobes of focus points. As a result, the protection of main tissue structure is expected to be greatly improved in HIFU surgery.

환청을 동반한 정신분열병 환자를 위한 가상 환청자극 노출 시스템의 개발: 타당성 파악을 위한 예비연구

신영석[1], 구정훈[1], 한기완[1], 이형래[1], 박진식[1], 박일호[2], 김재진[2], 김인영[1], 김선일[1]
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Virtual Auditory Hallucinations Exposure System for Schizophrenia with Auditory Hallucinations: Preliminary Study for Validation

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Abstract

Auditory hallucinations(AHs) is a false or distorted hearing perception with a compelling sense of its reality, and associated with psychotic disorders such as schizophrenia. Patients with schizophrenia who suffered from the AHs could easily be disturbed to their behavior or thought by their hallucination. Cognitive Behavioral Treatments(CBT) has limitations due to the absence of assistive tool for giving similar and relative stimuli in several situations. In this study we propose the virtual auditory hallucination exposure system(Virtual Hall). The results indicated that five patients who were still suffer from their hallucination showed sensitive and strong responses to the virtual auditory hallucinations(V-AHs) stimuli performing tasks in VE. In particular, they showed uneasiness, anxiousness and strain to irrelevant and negative V-AHs. They reported it is very similar with their real experiences. Therefore, this system will be use to cognitive behavior therapy about AHs as useful tools because it could be help to perception the erroneous thoughts and wrong reactions from auditory hallucination.

잉크젯 프린터를 이용한 박테리아 패터닝

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Bacterial Patterning by Inkjet Printer

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Abstract

Patterning bacteria and cells on substrates has potential applications in molecular biology, antimicrobial drug screening, environmental monitoring and tissue engineering. We developed a technique to deposit a single bacterial cell onto an agar plate by modifying a commercially available thermal inkjet printer. The concentration of the bacterial solution in the cartridge was carefully determined to ensure a single cell suspension in a droplet ejected from a nozzle. We measured quantitatively the effects of the bacterial concentration and the agar concentration on patterning performance. Bacterial patterning by inkjet printer is a low-cost and versatile technique which may replace the existing sophisticated methods.

SU-8 Shadow Mask를 이용한 마이크로 렌즈 제작

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Microlens Fabrication using SU-8 Shadow Mask

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Abstract

This paper reports a simple and easy-to-fabricate novel method for microlens using poly(dimethylsiloxane) (PDMS) and SU-8. We used a SU-8 shadow-mask, compressed air pressure, and thin plastic film as membrane. Microholes were patterned on the SU-8 shadow-mask by using photolithography method. And then thin plastic film was covered on the microholes-patterned shadow-mask. Then a vacuum pressure was applied from bottom of the shadow-mask. By this method, we could fabricate the arrayed convex PDMS posts. We performed the experiment about using as microlens for show the letters. We expect this microlens structure can be used for cell biology.

광학적 특성 조절이 가능한 Poly(dimethylsiloxane)

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Adjustable Optical Property of Poly(dimethylsiloxane)

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Abstract

Poly(dimethylsiloxane) (PDMS) is a promising material for microfluidic fields due to its flexibility, biocompatibility and transeparency, and its applications in biology, chemistry, and medicine seems unlimited. Light responsive characteristics of cells (especially plant cells and optic nerve cells) may need to be investigated in the microfluidic systems for cure of its related diseases and for development of plant energy recourses. Thus, we have developed optical adjustable PDMS. We mixed commercial dyes with PDMS solutions and fabricated the colored PDMS substrates. The color was safely maintained after its exposure to high humid and temperature. As a matter of course, the observation was possible due to its transparent property, therefore the colored-PDMS is available for conventional microscopic procedures. In addition, the thick colored PDMS can block the light. The method proposed in this paper will be useful for analysis of various light-sensitive cells.

상호작용 방법의 차이에 따른 정서인지의 차이; 뇌기능영상 연구

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The difference of emotional cognition by different interaction methods; An fMRI study

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Abstract

Recently, the advent of a interaction technology, the user is able to experience virtual environments of more real-like environments. These difference of interaction methods cause different feeling of presence. The feeling of presence affect to emotional cognition. But, it is unclear how the presence affect to emotional cognition. In this study, we performed a fMRI study to investigate that effect of different interaction methods to emotional cognition. For these purpose, we developed virtual environments that the user make a request handshaking with a avatar, then the avatar did acceptive or rejective action. The different presece was caused by real-like and unreal-like interaction method. In the results, real-like interaction methods caused higher presence and social presence. The superior medial gyrus to be related positive emotion was activated in both interaction methods. But, the superior temporal sulcus and superior frontal gyrus to be related negative emotion were differently activated by interaction methods. The superior temporal sulcus activated only unreal-like interaction method. The superior frontal gyrus activated only real-like interaction method.

고정된 Maxwell coil과 회전형 Helmholtz coil을 이용한 자기 추력

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Magnetic Propulsion Using Fixed Maxwell Coils and a Rotating Helmholtz Coil

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Abstract

The Maxwell coil is a widely used gradient coil for MRI. The Maxwell coil can be used for magnetic propulsion of a magnetic particle in a living subject. Although the Maxwell coil produces quite uniform gradient field in the middle of the coil, it does not make uniform direction of magnetization at region of interest. which hampers the controllability of the magnetic propulsion. When we use a Helmholtz coil or a solenoid coil, we can make uniform direction of magnetization at ROI. Then magnetic force direction depends on the direction of magnetization rather than the gradient field of a Maxwell coil. In this paper, we have calculated the magnetic force exerted by the Maxwell-Helmholtz coils and verified the calculation with experiments.

포스터 Ⅱ

이석기관의 이상을 진단하기 위한 PC기반의
주관적 수직 및 수평검사 시스템 (SVV&SVH)구현에 대한 고찰

김원규[1], 김현준[1], 서현원[1], 김태종[1], 권혁남[1], 김병태[1,2]
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A study on the Implementation
of PC based SVV&SVH(Subjective visual vertical & horizontal) test system

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Abstract

SVV&SVH(Subjective visual vertical & horizontal) test provides a useful method for assessment of abnormalities are presumably related to a lesion of the utricle.

The former systems organization for the utricle analysis were inconvenient because it was composed of the hardware method is additional in fixed type analysis system.

In this study, Samsung Medical Center is to present a plan for improving usability and applications through implementation of the SVV&SVH test system of PC bases which hit to the demand of the user.

ISO13485를 적용한 초음파영상진단기기의 도플러 모드 QC

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The doppler mode QC of ultrasound imaging system with ISO13485

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Abstract

Ultrasound doppler quality control does not judge image quality but rather the accuracy of measured hemodynamic values such as volumetric flow rate, peak velocity and pressure. Routine quality control checks must determine whether the doppler system, including its transducers, is functioning properly for clinical use based on the system's continuing ability to accurately measure blood flow parameters. The purpose is to recognize system performance change due to component degradation.

In this paper, we improve the accuracy of measured hemodynamic values executing ultrasound doppler quality control with ISO13485.

마취기 Flow sensor의 정확도 유지를 위한 Risk Management

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Risk Management of Anaesthesia machine flow sensor for the accuracy

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Abstract

The existing medical device managements are performed through each medical service manual. These kinds of managements don't include any checking cycles, concreted classifications. The USA has the standards which are EC6.10, EP5 at Joint Commission. Especially each medical center has already hade the standards of medical device managements and are performing the standards. It is also making a generalization. Samsung medical center is performing selecting the medical device and managing that around the the LSS(Life Support System). This dissertation would like to remove risk factors through RMA(Risk Management Action) before the event and study about the case of anaesthesia device which is been using by Samsung Medical Center.

Spin-Echo MR Imaging을 이용한 자성체의 위치 추적

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Positioning and Tracking of a Ferromagnetic Core Using Spin-Echo MR Imaging

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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 such as coronary angioplasty, localized drug delivery, and minimally invasive surgery in modern interventional medicine. 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 a spin-echo imaging sequence. The simulation for tracking and positioning of the ferromagnetic core in MR spin-echo images has been performed and the position of the ferromagnetic core has been calculated from the simulation information analysis. We have shown positioning errors among the images obtained with a spin-echo pulse sequence.

레이저 자극이 근육세포의 증식과 유전자 발현에 미치는 영향

곽지현, 김병관, 박수지, 정병조, 김지현

연세대학교 보건과학대학 의공학과

Effects of Laser Treatment on C_2C_{12} Myoblast Cells

J. H. Kwag, B. G. Kim, S. J. Park, B. Jung, C. H. Kim

Department of Biomedical Engineering, Yonsei University

Abstract

Laser irradiation is known to affect various tissues such as skin, bone, nerve, and skeletal muscle tissues. In skeletal muscle, laser irradiation is related to proliferation of skeletal muscle satellite cells. Their processes are activated by gene expression related with myogenesis such as muscle-specific transcription factors (MyoD and Myf5) and VEGF (vascular endothelial growth factor). In this study, we hypothesized that laser irradiation would enhance muscle regeneration through modulation of the gene expressions related with the differentiation of skeletal muscle satellite cells.

조영제를 이용한 Micro-CT 소동물 촬영

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Micro-CT small animal imaging with contrast agents

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Abstract

Micro computed tomography (Micro-CT) is now widely used for small animal imaging because micro-CT systems are very powerful to get anatomical structure informations.

Hard tissues like bone structures have good contrast in CT imaging. On the other hand, soft tissue have relatively lower contrast. Therefore, contrast agents are usually used in tissue imaging to enhance the contrast of soft tissues.

We got 3D reconstructed images of rats by using two kinds of contrast agents, a conventional iodine agent and a newly developed lipid-based agent (Fenestra LC), to decide which is more acceptable for Micro-CT imaging.

We have found that Fenestra LC can provide more distinguishable anatomical informations.

턱 움직임 시뮬레이션 시스템을 이용한 하악 비대칭 운동의 동적인 분석

김대승[1], 황순정[3], 최순철[2], 이삼선[2], 허민석[2], 허경회[2], 이원진[2]

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Dynamic analysis of the mandibular asymmetric movement using the jaw movement simulation system

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Abstract

In this paper, asymmetric condylar movement was analyzed using the jaw movement simulation system. For the jaw movement tracking, the mandibular part was manually segmented from the CT data and three-dimensional surface model of the maxilla and mandible was constructed. The Mandibular movements of the 15 subjects were obtained using optical tracking sensor. The movement of the mandible was measured and recorded in files. Simulation of the jaw movement was rendered smoothly and positional data of reference points were calculated. Asymmetric condylar dislocation was identified by comparing the simulation results with the trajectory data of reference points. Dynamic simulation of the mandible is useful for more accurate analysis of the jaw movement.

기능적 EIT 영상법을 이용한 실험견 폐 내부의 공기분포 영상화

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In Vivo Imaging of Air Distribution in Canine Lungs using Functional EIT

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Abstract

We performed multi-frequency time-difference EIT (mftdEIT) imaging experiments of the canine thorax using a lately developed mfEIT system KHU Mark1. Collecting complex voltage data at 1, 10, 50, and 100 kHz, we produced a time series of real and imaginary part images at 10, 50, and 100 kHz. They showed changes of a complex conductivity distribution inside the thorax during breathing cycles. For the image reconstruction, we used a mftdEIT image reconstruction algorithm based on a concept o the equivalent homogeneous complex conductivity. Adopting the functional EIT method, we presented standard deviation images for three different postures of sitting, left lateral, and right lateral positions. Real and imaginary part images clearly showed that air distributions inside the lungs change depending upon the postures. We suggest future studies of more experimental validations and clinical trials to human.

측두엽 간질 환자에서의 대뇌 피질의 두께 변화 관찰

김선형[1], 이종민[1], 태우석[2], 홍승봉[2], 김인영[1], 김선일[1]

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Cortical thickness changes in mesial temporal lobe epilepsy: cross-sectional and longitudinal studies

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Abstract

Longitudinal imaging studies enable the observation of the cumulative effects of mTLE in vivo and provide information about the pathogenesis of the structural abnormalities in mTLE. We examined changes in cortical thickness in mTLE patients by cross-sectional and longitudinal analyses using the constrained Laplacian-based automated segmentation with proximities (CLASP) algorithm with fourteen mTLE patients.

In the cross-sectional study, mTLE patients showed significantly decreased cortical thickness in multiple ipsilateral regions, as compared with normal controls. Our longitudinal study also showed a reduction in cortical thickness in the superior temporal lobeand frontal lobe in the ipsilateral hemisphere. We inferred that most of the cortical thickness reduction in the bilateral temporal lobe was highly correlated with the duration of mTLE.

기댓값 최대화 재구성 알고리즘을 위한 상이한 투사기-역투사기 연구

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Study for Unmatched Projector-Backprojector Pair in Expectation-Maximization Reconstruction Algorithm

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Abstract

The expectation maximization (EM) algorithm is an iterative reconstruction method and provides a more accurate image than the filtered backprojection (FBP). Since the most time-consuming taskof EM algorithm is the iterative calculation of projection and backprojection, the efficient modeling techniques for the projector-backprojector pair were required. In this study, we implemented ray-tracing method (RTM) and pixel-driven method (PDM) for the modeling techniquesand investigated the efficacy of three different projector-backprojecor pairs, RTM/RTM, PDM/PDM and RTM/PDM in EM algorithm. The simulation results showed that the most degraded images were obtained by the RTM projector-backprojector pair (RTM/RTM) and the RTM-projector and PDM-backprojector pair which is an unmatched projector-backprojector pair, efficiently removed the ring-artifact of the reconstructed image.

MREIT 시스템을 이용한 실험견 사체 두부의 도전율 영상

김영태[1], 정우철[1], Atul S. Minhas[1], 김형중[1], 이태휘[1], 강병택[2], 박희명[2], 우응제[1]

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Conductivity Imaging of a Canine Head using 3T MREIT System: Postmortem Experiment

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Abstract

Conductivity of biological tissues depend on molecular composition, geometry of intra- and extra-cellular space, concentration and mobility of ions, and other factors. Magnetic Resonance Electrical Impedance Tomography (MREIT) is a new bio-imaging modality providing cross-sectional conductivity images from measurements of internal magnetic flux densities produced by externally injected currents. Recent MREIT experiments focused on postmortem and in vivo canine brain. However, the head imaging was not achieved due to the small size of recessed electrodes and large amount of noise in magnetic flux density image. In this study, we used two pairs of carbon-hydrogel electrodes with a large contact area and injected 30mA imaging current through a canine head. We performed MREIT imaging experiments of the normal canine head and could reconstruct high resolution conductivity images of the head. Reconstructed conductivity images of the canine head show a good contrast not only inside but also outside the brain region.

Functional change of prefrontal cortex associated with semantic language processing in TLE patients after temporal lobectomy

김재훈[1], 이종민[1], 강은주[2], 조항준[1], 김치헌[3], 김준식[3], 송인찬[4], 정천기[3], 김선일[1]

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Functional change of prefrontal cortex associated with semantic language processing in TLE patients after temporal lobectomy

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Abstract

The focus of this study is functional change associated with semantic aspects of language function in patients with medial temporal lobe epilepsy (TLE) after successful surgery. The left and right TLE patient groups showed left inferior prefrontal activations associated with semantic processing after anterior temporal lobectomy. The longer the duration of epilepsy in the patients, the larger the increase in the left inferior prefrontal semantic-associated activation after surgery in both patient groups. These results indicate that preoperatively, dysfunctions of the medial temporal lobe affect left inferior prefrontal functions that underlie finding semantically-relevant words in the context of grammatical rules, and that the recovery from the devastating effects of the epileptic zone might cause reversible functional change within semantic language processing network, suggesting an intra-hemispheric reorganization following surgery.

정상인 남녀 종아리의 MREIT 도전율 영상

김형중[1], 김영태[1], 정우철[1], Atul S. Minhas[1], 우응제[1], 권오정[2]

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In Vivo MREIT Conductivity Imaging of Human Calf

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Abstract

Magnetic Resonance Electrical Impedance Tomography(MREIT) provides cross-sectional images of conductivity distribution inside an imaging subject. Following numerous phantom and animal imaging experiments, most recent studies demonstrated successful conductivity image reconstructions of in vivo human calf using a 3 T MREIT system with 9 mA imaging currents. This paper reports our human imaging experiment in normal healthy male and female volunteers. 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 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. There was no significant difference between male and female.

최소 침습형 레이저 프로브 시스템 개발

류연항, 이용흠, 손태윤, 강희성, 윤진희, 배영우, 정병조

연세대학교 보건과학대학 의공학부

Laser Probe System For Minimal Invasive Surgery

Y. H. Ryu, Y., H. Lee, T. Y. Son, H. S. Kang, J. H. Yoon, Y. W. Bae, B. J. Jung

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Abstract

Currently, the acupunctures such as electricity needle, magnetic field needle, infrared ray needle, laser needle and ultrasonic wave needle have been used as an alternative tools for traditional acupuncture. However, it has not been achievable for non-invasive laser acupuncture the same medical treatment efficacy compared to the traditional acupuncture because it could not deliver sufficient radiation to the acupuncture points which are below the skin surface. Therefore, the object of the study is to improve the medical treatment efficacy of laser acupuncture and to apply more various clinical areas by developing a fine needle laser probe system. To address the issue, we developed a single channel fine needle laser probe system that could provide both thermal and acupuncture stimulation for the acupuncture point simultaneously.

침술과정 및 효과에 대한 전기적 해석

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Electrical Analysis for Acupuncture Procedure and Electric Effects

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Abstract

In the study, we observed the electric potential along the stomach meridian (ST) in order to verify the energy consensus phenomenon by transportation of bio-energy between operator and subject with an acupuncture. Also, we investigated acupuncture affects of the opposite meridian site by comparing the electric potential between the right and left sites. As a result, In the acupuncture procedure, meridian electric potential(MEP) between operator and subject is generated simultaneously. The polarity of the MEP was opposition. It implies that there is closely connected with bio-energy transportation between operator and subject. Moreover, it should be noted that the electric potential with difference three patterns of both sites represents the condition of the related meridians because meridians in the body are organically interconnected.

병렬 연산을 이용한 이미지 재구성의 속도향상

박민재, 이재성, 김수미, 이동수, 박광석
서울대학교 협동과정 의공학교실, 서울대학교 의과대학 핵의학교실

Enhacement of reconsturction speed using parallel processing

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Abstract

Though acquisition time can be reduced by simultaneous dual isotope imaging protocol in SPECT, there is no common method to remove contamination of down-scatter of high energy source. As a prior study, we suggest a simple matrix calculation of each energy band based on scatter count is related with primary count. To find out the matrix calculation is effective, we simulated with Jasjak phantom in SIMIND.

혈관성 장애 환자의 자기공명 뇌영상의 비정상적 명암 측정 및 국부적 분포의 자동 분석에 관한 연구

박준성[1], 이종민[1], 구방본[1], 서상원[2], 나덕렬[2], 김인영[1], 김선일[1]
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A fully automatic method to measure the regional distribution of white matter hyperintensities in vascular cognitive impairment and dementia.

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Abstract

Associations between regional white matter hyperintensities (WMH) pathology and neuropsychological performance in patients with vascular risk factors are receiving attention. However, research has been largely contradictory and inconclusive in the WMH volume quantification methods and the ROIs of WMH. In this paper, the WMH volume was automatically measured in each lobe. Then, the relationship between regional WMH volume and Mini-Mental State Examination (MMSE) was investigated in patient with subcortical vascular dementia (SVaD) and subcortical vascular mild cognitive impairment (svMCI).

고강도 집속초음파 적용 영역의 온도변화 측정 시뮬레이션

백은솔, 서종범
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Simulation of Measurement for Temperature Changes Induced by High Intensity Focused Ultrasound

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Abstract

It is important to ensure the result of treatment on-line in high-intensity focused ultrasound ablation. To measure the temperature changes in focal spot via ultrasonic image we propose the model for thermal lateral expansion of tissue. This model use a speckle tracking method with lateral phases to estimate the lateral displacement of each scatterer. The simulation results show that the average error and the standard deviations are about 10 % and 30 μm, respectively, where the displacement of scatterers is 40 μm. A kernel size and a filter used simulation may be required to adjust to improve errors and variation.

펄스 반전 칼라 플로우 영상을 위한 대역 선택적 회귀 필터를 이용한 클러터 제거 기법

손왕영, 이재진, 강현, 송태경

서강대학교 전자공학과

A Clutter Rejection Methods Using a Band-selective Regression Filter for Pulse-inversion Color Flow Imaging

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Abstract

An efficient clutter filtering method to increase the detectable Doppler frequency range in pulse inversion color flow imaging is presented. The proposed band selective regression filter can reject more effectively the clutter in a wider frequency range than the conventional filters. The proposed band selective regression filter can suppress the clutter signal by more than 100dB by using a base function composed of frequency components in the clutter frequency band. Computer simulation results show that the band selective regression filter can increase the Doppler detection frequency range by 0.05 PRF to 0.1 PRF and improve the accuracy of the estimated blood flow velocity by up to 8%, with only a small increase in hardware complexity.

치료용 근접 방사선원의 실시간 위치 판별을 위한 유기 섬광 광섬유 집합체 센서의 제작

신상훈[1], 조동현[1], 장경원[1], 유욱재[1], 서정기[1], 이봉수[1], 문주현[2]

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Fabrication of organic scintillating optical fiber bundle sensor for detecting position of Ir-192 source

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Abstract

The objectives of this study are to measure in vivo dose distributions of the high dose rate (HDR) brachytherapy source (Ir-192) and to find a location of the source in a body during cancer treatment. Additionally, normalized depth dose curves will be obtained easily using a coherent scintillating fiber-optic bundle sensor and a PMMA phantom. To measure multichannel light signals simultaneously, a charge-coupled device (CCD) is used and each light signal generated from a organic scintillator is guided independently to a CCD.

디지털 맘모그래피 영상에서 미소석회질 검출에 관한 연구

오휘빈, 김영재, 김광기, 최형석, 서영욱, 안동헌, 조영호

국립암센터 기초과학연구부 의공학 연구과

A Study on Detection of Micro-calcification in Digital Mammography

W.V. Oh, Y.J. Kim, K.G. Kim, H.S. Choi, Y.W. Seo, D.H. An, Y.H. Cho

Bionmedical Engineering Branch, Division of Basic Science, National Cancer Center

Abstract

This paper presents a CAD system for the automatic detection of clustered micro-calcifications in digitized mammograms. The proposed system consists of three main steps. First, breast region is segmented from original mammogram using contrast property of grey level co-occurrence matrix(GLCM). Second, potential micro-calcification pixels in the mammograms are detected by gaussian distribution function. Third, in order to reduce false-positive rate, individual micro-calcifications are detected by a set of 8 features extracted from the potential individual micro-calcification objects. In the result, Specificity and sensitivity are used to evaluate the detection performance of micro-calcifications.(sensitivity : 92.1%, specificity : 88.5%). This study could be a useful method for diagnosis of breast cancer as a CAD system

실버 핼라이드 광섬유를 이용한 고주파 열치료용 비접촉식 온도측정 어레이 센서

유욱재, 서정기, 조동현, 장경원, 신상훈, 이봉수

건국대학교 의료생명대학 의학공학부, 의공학 실용기술 연구소

Noncontact Temperature Array Sensor using Silver Halide Optical Fibers for Radiofrequency Ablation

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Abstract

We have measured temperature distribution using the silver halide optical fibers during radiofrequency ablation (RFA). Infrared radiations generated from the water around inserted electrode are transferred by the three silver halide optical fibers and are measured by a thermopile sensor array. Also, the output voltages of the thermopile sensor array are compared with those of the thermocouple recorder. It is expected that a noncontact temperature sensor using silver halide optical fibers can be developed for the temperature monitoring during RFA treatments based on the results of this study.

MR 영상을 이용한 20대, 40대 정상 한국인의 안구 부피 계측

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

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Abstract

본 연구에서는 MR 영상을 이용하여 20대와 40대 정상 한국 성인의 안구 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 안구 부피의 평균은 $6.07\pm0.67[cm^3]$ 이었다. 20대 안구 부피 평균은 $6.52\pm0.62[cm^3]$이고 40대 안구 부피 평균은 $5.63\pm0.34[cm^3]$로서 40대에 비해 20대의 안구의 부피가 더 컸다. 남자는 $6.30\pm0.71[cm^3]$이고 여자는 $5.89\pm0.58[cm^3]$로서 여자에 비해 남자의 안구 부피가 더 컸다.

치과임플란트용 수술네비게이션 시스템

이우진[1], 이원진[2], 김대승[1], 허민석[2], 이삼선[2], 최순철[2], 허경회[2]

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Surgical Navigation System for Dental Implant

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[2]Department of Oral and Maxillofacial Radiology, BK21, and Dental Research Institute, School of Dentistry, Seoul National University

Abstract

This paper proposes a image guided navigation system in dental implant surgery. Since the influx of dental implants, dental computed tomography imaging have been used as a diagnostic kit for preoperative planning, but not as a part of the surgical phase. In this study, describes the use of a landmark-based surgical navigation system for dental implant. It is based on the application composed of the following modules: 1) Visualization: This module provides accurate details of the anatomic structures for oral and maxillofacial surgical procedures. 2) Real-time surgical navigation: It is based on optical tracking sensor. 3) Correct drilling tool tip: It maintains precise length of offset from drilling marker to end of tool tip. We conclude that this method is convenient and useful for dental implant surgery.

단위 영상 중첩 방법을 이용한 합성 구경 집속 시스템의 구현

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Implementation of Synthetic Aperture Focusing System using Frame Overlapped Method

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Abstract

Synthetic Aperture Focusing(SAF) was initially devised to improve poor resolution and contrast produced by the conventional medical ultrasound system due to its fixed transmit focusing. However, as known to many, it is hard to implement SAF because it requires a very complex hardware to focus to multiple scanlines after one Tx/Rx has been made.

In oder to reduce the level of complexity encountered in making hardware for SAF, this paper suggests Synthetic Aperture Focusing using Frame Overlapped Method. It can achieve the image quality expected as those of original SAF by overlapping low-resolution frames, obtained from employing different element. It can be easily implemented without additional cost by putting the persistence process before demodulator that the conventional medical ultrasound system have.

The proposed method is verified through running simulation for a 3.5MHz convex array using data acquired from the human kidney. The result demonstrates that the suggested method have the same quality of resolution and contrast as original SAF without adding some hardware to the conventional medical ultrasound system.

다주파수 시간차 EIT 영상법을 이용한 소화 기능의 영상화

이재웅, 권지현, 구환, 우응제
경희대학교 동서의료공학과

Multi-frequency Time-difference EIT Imaging of Abdomen using KHU Mark1

J. W. Lee, J. H. Kuen, H. Koo, and E. J. Woo
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Abstract

We performed multi-frequency time-difference EIT (mftdEIT) imaging experiments of the human abdomen using a lately developed mfEIT system KHU Mark1. We produced real and imaginary part images of time changes in complex conductivity distributions at 10, 50, and 100 kHz during stomach filling and emptying periods. Reconstructed time-difference images of the abdomen show progressive filling and emptying of the stomach. We found that imaging the stomach emptying process is rather difficult due to motion artifacts during a long imaging time of hours. We found that mftdEIT needs improvements in terms of its robustness against motion artifacts.

정상인 뇌 에서 대뇌 피질 구조와 뇌의 크기와의 관계

임기호, 이종민, 김선형, 김선일

한양대학교 의용생체공학부

The relationship between brain size and cortical structure in the human brain

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Department of Biomedical Engineering, Hanyang University

Abstract

We investigated the scale relationship between size and cortical structure of human brains in a large sample of MRI data. Cortical structure was estimated with several measures (cortical volume, surface area, and thickness, sulcal depth, and absolute mean curvature in sulcal regions and sulcal walls) using 3-D surface-based methods in 148 normal subjects (n(men/women): 83/65,age(mean ± SD): 25.0 ± 4.9 years). We found significantly larger scaling exponents than geometrically predicted for cortical surface area, absolute mean curvature in sulcal regions and in sulcal walls, and smaller ones for cortical volume and thickness. As brain size increases, the cortex thickens only slightly, but the degree of sulcal convolution increases dramatically, indicating that human cortices are not simply scaled versions of one another. Our results are consistent with previous hypotheses that greater local clustering of interneuronal connections would be required in a larger brain, and fiber tension between local cortical areas would induce cortical folds. We suggest that sex effects are explained by brain size effects in cortical structure at a macroscopic and lobar regional level, and that it is necessary to consider true relationships between cortical measures and brain size due to the limitations of linear stereotaxic normalization.

색정보를 이용한 복강경 수술도구 분할

임혜원[1], 박준우[1], 김광기[1], 김영우[2], 조영호[1]

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Segmentation of Laparoscopic Surgical Instruments using Color Information

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Abstract

In this paper, we present a simple but robust algorithm that only uses color information to segment surgical instruments in laparoscopic surgery. The method makes use of the fact that standard laparoscopic instruments are made up of black, grey and white colors in laparoscopic images. These colors all share the same property that their R, G and B values are equal to or highly close to each other. Hence, instruments are segmented by comparing R, G and B values of each pixel in image. Our algorithm was applied to images acquired from both experimental setting and pre-recorded video stream of a real laparoscopic surgery. Results show that our method is robust to different image acquisition environment and partial occlusions of instruments.

KHU Mark1 EIT 시스템을 이용한 목의 시간차 영상획득 기초실험

정선윤, 권지현, 우응제

경희대학교 전자정보대학 동서의료공학과

Preliminary Experiment of Time-difference EIT Imaging of Neck using KHU Mark1

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Department of Biomedical Engineering, College of Electronics & Information, Kyung Hee University

Abstract

In this paper, we performed multi-frequency time-difference EIT (mftdEIT) imaging experiments of the human neck using a lately developed mfEIT system KHU Mark1. Collecting complex voltage data at 50kHz, we produced a time series of real and imaginary part images. They showed changes of a complex conductivity distribution inside the neck during different stages of breathing and drinking. In the breathing experiments, we presented images for three different stages of apnea, inhalation, and exhalation. For drinking experiments, we presented images of three different motions including swallowing saliva, drinking distilled water, and drinking ion drink. Real part images showed that air distributions inside the neck change depending upon the quantity of air and the rhythmical contraction of the neck muscle. We found that it is rather difficult to interpret imaginary part images in this preliminary nect imaging experiments.

모폴로지를 이용한 맥락막 혈관 영상 강조

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Enhancement of a choroid vessel by using morphology

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Abstract

In this paper, we proposed new algorithm to identify choroid vessel by lessening intensification of retina vessel information. The choroid vessel morphology relate with loss sight, so we need to way for detecting artery, and vein in choroid. For the aim, we apply retina vessel detection method, that are multiscale, hysteresis thresholding, KNN classification solution, to selected image, and adopting erosion in morphology of image processing reduce the retina vessel information. In conclusion, the vessel in choroid enhanced that the vessel in original image

고에너지 X-선 조사에 의한 광섬유 방사선량계와
EBT film의 심부선량 백분율 측정 및 비교

조동현[1], 장경원[1], 유욱재[1], 신상훈[1], 서정기[1], 이봉수[1], 조효성[2], 김 신[3]
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Measurements and comparisons of PDD from EBT film,
Fiber-optic Dosimeter Irradiated by High Energy Photon Beam

D.H. Cho[1], K.W. Jang[1], W.J. Yoo[1], S.H. Shin[1], J.K. Seo[1], B.S. Lee[1], H.S. Cho[2], S. Kim[3]
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[2]Department of Radiological Science, Yonsei University
[3]Department of Nuclear & Energy Engineering, Cheju University

Abstract

In this study, fiber-optic dosimeter (FOD) is fabricated to measure high energy X-ray beam of CLINAC. As a scintillating light generated by a high energy X-ray from the medical LINAC is measured using photo diode amp system. It is expected that a high-resolution, real-time fiber-optic dosimeter for medical LINAC can be developed.

부분 영역의 고해상 뇌기능자기공명 영상처리를 위한
대뇌피질 모델기반의 분석방법

조항준, 이종민, 김재훈, 임기호, 김인영, 김선일
한양대학교 의과대학 의공학교실

Cortical Surface-based fMRI analysis of High-Resolution Partial-Brain fMRI data

H. J. Jo, J. M. Lee, J. H. Kim, K. Im, I. Y. Kim and S. I. Kim
Department of Biomedical Engineering, College of Medicine, Hanyang University

Abstract

Surface-based functional magnetic resonance imaging (fMRI) analysis is more sensitive and accurate than volume-based analysis for detecting neural activation. However, these advantages are less important in practical fMRI experiments with commonly used 1.5-T magnetic resonance devices because of the resolution gap between the echo planar imaging data and the cortical surface models. We expect high-resolution segmented partial brain EPI data to overcome this problem, and the activation patterns of the high-resolution data could be different from the low-resolution data. In this study, we demonstrated the difference between activations detected by volume- and surface-based methods using low- and high-resolution EPI data at 1.5T. First, we compared the activation maps of low- and high-resolution EPI datasets, which was detected by volume- and surface-based analyses, with the spatial patterns of activation clusters, and analyzed the cumulative distributions of the probabilistic scores of activated regions.

랜덤포레스트를 이용한 미세석회화의 통계적 판별에 대한 연구

최형석, 김광기, 오휘빈, 서영욱, 안동헌, 조영호
국립암센터 기초과학연구부 의공학연구과

Statistical Classification Study on Microcalcification Using Random Forest

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Biomedical Engineering Branch, Division of Basic Science, National Cancer Center

Abstract

Microcalcification in mammograms is important to detect breast cancers early. The detection of microcalcification is difficult and complicate because of its regular features. computer aided diagnosis (CAD) is useful in the detection of microcalcification in mammograms and developed by several algorithms. We made statistical classifier model using Random Forest and test it. We made two models according to learning methods. We suggest that two class learning using foregrounds and backgrounds are more sensitive than regular division by pixels.

Conductivity Imaging of Postmortem Canine Abdomen using 3T MREIT System

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Conductivity Imaging of Postmortem Canine Abdomen using 3T MREIT System

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Abstract

Magnetic resonance electrical impedance tomography (MREIT) has the potential to provide conductivity images with high spatial resolution and accuracy. In recent years, several animal postmortem and in vivo experiments have been performed to testify the clinical credibility of the MREIT technique in the brain region. In this work, we show that high-resolution conductivity imaging of the canine abdomen is possible by application of carbon-hydrogel electrode and optimized RF coil for the canine abdomen. Multi-slice conductivity images show significant conductivity contrast among the kidney, liver, spleen, small intestine, and spinal cord which are compared with typical MRI magnitude images.

Validation of Convex Nonquadratic Spline Priors for Bayesian Limited Angle Tomography Reconstruction

Van-Giang Nguyen, Soo-Jin Lee

배재대학교 전자공학과

Validation of Convex Nonquadratic Spline Priors for Bayesian Limited Angle Tomography Reconstruction

Van-Giang Nguyen and Soo-Jin Lee

Department of Electronic Engineering, Paichai University

Abstract

We validate performance of convex non-quadratic (CNQ) spline priors applied to Bayesian limited angle tomography reconstruction.

Since limited-angle data lack projection views over some angular ranges, they produce poor reconstructions with artifacts. To obtain a good solution, a more expressive prior than the conventional prior that assumes a simple piecewise constant source is needed. The CNQ spline prior used in our work is expressed as a linear combination of the 1st and the 2nd order spatial derivatives. For fast convergence, we use the globally convergent BSREM (block sequential regularized expectation maximization) algorithm. Our experimental results indicate good performance of the CNQ prior in terms of the convergence speed as well as the reconstruction accuracy for realistic phantoms.

신경 활동에 따른 반사율 변화를 이용한 광섬유 기반의 신경 신호 검출

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Fiber-based detection of reflectance change during neural activation

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Abstract

Electrodes, one of the most widely used method for neural recording, have the drawback in their long-term reliability. The electrode implanted into the brain frequently stops working when reactive responses of brain tissues induce a fibrous and cellular sheath encapsulating the conductor surface of the electrode. As a new chronic neural recording technique, this study suggests an optical neural probe. We have built a fiber-based system to monitor changes in the reflectance of a brain tissue during neural activation. As the result, we found a concurrent optical change with the electrical response (population spike) in rat hippocampal slices. This finding will be applied to realization of the chronic optical neural probe.

발 압력 신호를 이용한 파킨슨 환자 보행의 인식

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Pathological Gait Recognition of Parkinson Patients using Plantar Pressure signal

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[4]Dept. of Biomedical Engineering, College of Medicine, Seoul National University

Abstract

The purpose of this paper is to identify mild gait of Parkinson disease (PD) patients from severe gait of PD patients using machine classifier. We used plantar pressure signal during free walking. The gait data were obtained from 21 patients with Parkinson disease. For feature selection of gait, we divided anatomical area of foot into ten regions and calculated peak pressure, instant of peak pressure, and pressure time integral at 10 regions as a gait feautures. Then, we build Support Vector Machine (SVM) classifier for the identification of pathological gait and tested the performance using gait features. SVM result indicated an overall accuracy of 95.78% by the linear kernel function. These results demonstrate considerable potential in applying SVM in gait recognition for many applications.

금속 나노선 물질에 따른 표면 플라즈몬 공명 바이오센서의 감도 향상 특성

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Nanowire Material Dependence of Sensitivity Enhancement in Nanowire-mediated Surface Plasmon Resonance Biosensors

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Abstract

A nanowire-mediated substrate of a surface plasmon resonance (SPR) biosensor has been investigated to study sensitivity characteristics depending on the nanowire material. Numerical results demonstrate that gold, silver, and copper nanowire can provide highly enhanced sensitivity compared to a conventional SPR biosensor. Among them, copper nanowires show the best performance and its optimal structure can provide a sensitivity enhancement by more than 18 times.

나노선이 적용된 표면 플라즈몬 공명 바이오센서에서
반응 물질의 결합 위치에 따른 감도 특성 연구

현재하, 변경민

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Effect of the Spatial Distribution of Target Analytes on the Sensitivity Characteristics of Nanowire-mediated Surface Plasmon Resonance Biosensors

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Abstract

A nanowire-mediated substrate of a surface plasmon resonance (SPR) biosensor has been investigated to study an impact of spatial distribution of target analytes on the sensitivity characteristics. The numerical results demonstrate that an increase of surface reaction area between a self-assembled monolayer (SAM) and localized plasmons leads to a highly enhanced sensitivity enhancement. Especially, SPR characteristics are significantly dependent on the binding position and its enhanced local plasmon fields. An optimal nanowire structure can provide a sensitivity enhancement by 8.47 times compared to a conventional SPR biosensor

트레드밀에서의 에너지 소비량을 예측하기 위한 3축 가속도계와
신체정보를 이용한 다중회귀분석

강동원, 최진승, 문경률, 이정환, 정순철, 탁계래

건국대학교 의학공학부

Multiple regression analysis for estimation of energy expenditure on the treadmill by using 3-axis accelerometer and physical information

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Abstract

The purpose of this study is to estimate of the energy expenditure during physical activities. The physical activity is quantified by the integration of the accelerometer signals obtained from the 3-axis accelerometer fixed at the waist level of the human body. To find a relationship between energy expenditure and accelerometer data, 6 male subjects walked and ran on the treadmill with speeds of 1.5, 3.0, 4.5, 6.0, 6.5, 7.0, and 8.5 km/hr. Each subject performed walking at the speed lower than 6.0 km/hr and running at the speed higher than 6.5 km/hr. Actual energy expenditure was determined by a continuous direct gas analyzer. Two predictive equations of walking and running mode for energy expenditure which includes body mass index(BMI), age and data from accelerometer were developed using multiple regression analysis. The correlation coefficients and coefficients of determination between the estimated and measured energy expenditure are R=0.967, R2=0.934 and R=0.823, R2=0.678 in walking and running mode, respectively. For further study, experiments on a larger scale of test subjects are essential for acquiring more reliable results.

능동 족관절 보조기 착용 유무에 따른 노인의 족저굴곡 토크 보조

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Assist of Plantarflexion Torque in Elderly Adults on with and without the Active Ankle-Foot Orthosis

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Abstract

Ankle-foot orthosis(AFO) with a pneumatic rubber actuator, which is intended for the assistance and the enhancement of ankle muscular activities was developed. In this study, appropriate amount of power pattern of the device and the effectiveness of the system was investigated during plantarflexion motion of ankle joint. To find the appropriate amount of power pattern and the effectiveness of the system, the subjects performed maximal voluntary isokinetic plantarflexion contraction on a Biodex-dynamometer. Plantarfexion torque of the ankle joint is assisted by subject's soleus muscle that is generated when ankle joint do plantarflexion motion. We compared the maxmal plantarflexion torque between with active control of the AFO and without it in each ten young and elderly adluts. The subjects were performed the gait motion with and without the active control using muscle. We made a comparison the muscular activities between with and without the active control. The experiment results in plantarflexion motion showed that the muscular activities and peak torques with the AFO were reduced and the one wearing it were increased. Therefore, we confirmed the effectiveness of the developed AFO.

반복적인 유체전단응력에 반응하는 뼈세포의 섬모체에 대한 연구

김병관, 곽지현, 권이석, 김지현
연세대학교 보건과학대학 의공학과

Abrogation of Primary Cilia in Pre-Osteoblast inhibit Focal Adhesion Regeneration under Oscillatory Fluid Flow induced Shear Stress

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Abstract

Primary cilia is the microtubule based structure that is known to be an important factor in cell mechanotransduction. Recently, it is proved that primary cilia exists in bone cells, such as osteoblast and osteocyte, and related to PGE2 release and COX-2 gene expression responding to fluid flow induced shear stress. In this study, we hypothesized that primary cilia affects to focal adhesion which is mechanreceptor on cell membrane, that also increase PGE2 release and COX-2 gene expression in osteoblast under the condition of fluid shear stress. Our results indicated that abrogation of primary cilia in osteoblast decreased focal adhesion, which resulted in inhibition of PGE2 release and COX-2 gene expression. Therefore, we concluded that primary cilia is the crucial factor that is related to focal adhesion in the response of fluid shear stress of osteoblast.

골절방지 시스템의 개발을 위한 낙상 시뮬레이션의 충돌면 계수에 관한 연구

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Parameter Study on the Contact Surface of Fall Simulation for Development of Fracture Prevention System

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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.

젊은층 대비, 한국인 고령층의 맨발 보행시 족저압 특성 분석

문종필[1], 유창훈[1], 최진승[2], 강동원[2], 주종필[3], 탁계래[2], 이성재[1]

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Plantar Pressure Characteristics in Elderly during Bare Foot Walking as compared to the Young in Korean

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Abstract

Aging process involves the changes in foot that are related to structure and function. Typical features of the aged foot are decreased peripheral sensation and unevenly distributed plantar pressure patterns as compared to those of the young. Besides the finding that the foot shape can be different from gender, little is known about the plantar pressure characteristics in relation to gender. The purpose of this study was to investigate the plantar pressure characteristics of the elderly, especially the gender-related differences, and compare them to those of the young. This is a part of on-going effort for the improvement of footwear design for the elderly that can better reflect biomechanical characteristics of their foot.

20 males (15 elderly, 69±4.4 years; 5 young, 28.4±2.0 years) and 24 females (19 elderly, 69.2±5.9 years; 5 young, 21.2±0.5 years) were tested. All subjects had no foot pathologies and their plantar pressures (right foot) were measured with F-scan while walking at self-selected walking speed. The plantar regions were divided into eight anatomical masks where peak contact pressure (PCP) and contact areas (CA) were measured. To analyze age-related differences in gender, independent-samples t-Test was used.

Peak contact pressure results showed that the elderly group showed higher values overall as compared to the young, regardless of gender. Particularly, 120% higher PCP was noted at the mid-foot region (statistically significant) in male and 113% and 85% larger PCP at the female. No statistical gender differences were found regardless of age. Contact area results showed a similar trends as those of PCP. Higher contact area was seen with young male group at the hallux region. However, CA of elderly female was higher (statistically significant 5 out of 8 regions) as compared to the young female.

Our results suggest that high pressure concentrated at the mid-foot region. Therefore, mid-foot region needs a sole made of soft material for the elderly. In addition, design changes that can redistribute unwanted high pressure at the mid-foot and lateral forefoot (for the female) regions or larger sole would be beneficial for the improvement of their footwear.

쇄골 재건 고정판의 디자인과 기계적 성질

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Designs of the Clavicle Reconstruction Bone Plate and their Mechanical Properties

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Abstract

Three types of clavicle reconstruction bone plate with different thickness range from 0.4 to 3.4 mm were designed and manufactured, and bending tests of the plates were performed following the procedure defined in ASTM F382-99. The maximum bending load of the plate was found to be strongly dependent upon the smallest thickness of the plate. This result suggests that the permanent deformation and the breakage of the plate starts at the region where the thickness of the plate is the smallest and propagates from there horizontally across the bone plate. The finite element analysis of the bone plate showed that the area across the hole has a greater stress than the area between the hole and this result explain the fact that the breakage actually occurred across the hole in clinical application.

Characteristics in Frequency Domain of Postural Sway of Elderly Adults Participating in the Training for Postural Control

박용군[1], 오가영[2], 권대규[3,4], 김정자[3], 김동욱[3], 김남균[3]
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Characteristics in Frequency Domain of Postural Sway of Elderly Adults Participating in the Training for Postural Control

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Abstract

This study investigated the change in frequency domain of postural sway in the elderly adults before and after balance training. Fifteen elderly volunteers took part in a series of balance training exercises with a training system that consisted of an unstable platform, a safety harness, a monitoring device, and a computer. An additional 15 elderly volunteers comprised a control group without training. Measurements of postural sway in different standing positions were performed before and after training in the experimental group. The postural sway in the antero-posterior and medio-lateral directions was subjected to spectral analysis. The frequency spectrum of postural sway was calculated by fast Fourier transformation at frequency bands of 0.1 - 0.3Hz, 0.3 - 1Hz and 1 - 3Hz. Training effect resulted in significant increment of the mean frequency of postural sway after training for postural control. The frequency analysis revealed a significant change in the different frequency bands after training for postural control. The results suggest that the analysis in different frequency bands may be applied to analyze the contribution of the visual, vestibular system, and somatosensory for postural control.

고령자의 골절방지를 위한 휴대형 낙상 감지 시스템

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Portable Fall Detection System for the Fracture Prevention of the elderly

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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, we developed a portable fall detection system for the fracture prevention system of the elderly. The device is intended to detect a fall and activate a second device such as an air bag deployment system that can prevent fracture. The fall detection device employs a 3-axis acceleration sensor and a 2-axis tilt sensor. The developed fall detection device was successful in detecting a fall about 0.1 second before a severe impact to occur and detecting direction of the fall to give enough time and information for the fracture preventive device to be activated. The fall detection device was also able to differentiate fall from normal activities such as walking, sitting down, standing up, lying down, and running.

보청기에 마이크로폰 어레이를 이용한 시간과 주파수영역에서의 잡음제거

방동혁[1], 양동권[1], 전유용[1], 길세기[1], 이상민[1,2], 주상익[1,2]

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Noise Cancellation at the time and Frequency Domainay

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Abstract

This paper describes about noise cancellation method of the hearing aids. The signal is acquired by the omni-directional microphone array, and the data of signal is acquired by using DAQ(data acquisition unit). Noise cancellation is executed in the time and frequency domain. First, in the time domain, noise is removed by using the VAD(aoice activity detector) and ANC(adaptive noise cancellation) method. The execution of the VAD is to adjust for weighting of ANC by using the output signal. In the frequency domain, noise is removed by two method. The first method is that the input signal is divided into the speech and noise frame, and we remove the noise energy of the noise frame. Whenever data is acquired in frequency domain, division of speech and noise frame is decided to noise that is 10 frame from the beginning, and speech and noise frame is divided by speech correlation detection algorithm after 11 frame. The second method is that musical noise in speech frame is removed by musical noise cancellation algorithm. By our proposed noise cancellation algorithm, the results of NSR(Noise-to-signal ratio) show that the noise of the disyllable word is decreased within 9.23 ± 1.761[dB] and the noise of the sentence is decreased within 5.18 ± 0.679[dB].

뇌졸중 회복 향상을 위한 웹 기반의 무선 뇌 신경 자극 시스템 개발

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A Web-based Development of Wireless Neuro-modulation System for Enhanced Stroke Recovery

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Abstract

The direct cortical electric stimulation is a brand-new and potential candidate for better stroke recovery than conventional therapeutic methods. We developed a telemedicine system using ZigBee-based wireless electric stimulator linked with internet so that the patient with movement disorder can get proper reconfiguration of the electric stimulation without visiting doctors in the previous studies. However, the system had focus on the data transmission between the remote devices not on the various interactions among the patient, doctors and supporting system. It is important to provide interactive components in evaluation and rehabilitation of the brain diseased patient. This study aims at the web-based extension of the system to increase the helpful interactions for reliable evaluation and effective recovery of the stroke patients. The prototype system is being developed on the PC-based web server and database management system for viability test. The web-based approach can also be easily accessed and more open to upgrading development in the ubiquitous environments. Furthermore, it will be an open platform for many rehabilitation protocols and clinically verified therapeutic methods can be easily added as a digital contents and put into practice to many patients without proper healthcare.

트레드밀 운동 시 체질량 지수(Body Mass Index)에 따른 에너지 소모도 차이 비교

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Comparison of Energy Expenditure with Treadmill walking by Body Mass Index

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Abstract

In this study, we performed comparison of energy expenditure with treadmill walking accoding to Body Mass Index(BMI).
We compared the actual energy expenditure and calculated energy expenditure by treadmill. There was significant difference between actual energy expenditure and calculated energy expenditure by treadmill in relative Body Mass Index. Therefore the further study would be required to find the correlation of the two methods and calibrate the values from them.

직립 자세에서 지지면의 수평진동에 따른 동적 자세 응답

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Dynamic Postural Response on the of Horizontal Vibration of Support Surface in Standing Posture

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Abstract

This paper investigated the effects of dynamic postural response for maintaining upright standing on a support surface during horizontal vibration in anterior-posterior and medial-lateral direction. Seven healthy young subjects participated in this study. Postural control was analyzed by the measurement of COP (center of pressure) sway. Three different frequencies and amplitudes of support surface were employed : 0.5Hz, 1Hz and 2Hz at 0.5cm, 1cm and 1.5cm. The experiments were performed dynamic postural reponses at the condition of eye open and close. The electromyographic signals of the four muscles in lower extremities were recorded and analyzed in the frequency domain: the muscles of interest were rectus femoris (RF), biceps femoris (BF), gastrocnemius (Ga), tibialis anterior (TA). The experimental results showed the difference of muscular activities at the different frequencies, amplitudes and the vibration directions of the support surface. For the anterior-posterior and medial-lateral direction, the Ga showed highest activities. Also, the rate of the increase in the muscular activities was affected by the frequency and amplitude, except RF.

This paper could be applied to the dynamic postural training for the elderly and the rehabilitation training for the patients to improving the ability of postural control.

기립상태에서 발바닥 진동자극의 주파수에 따른 자세균형 응답

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Effects of plantar sole vibration using various frequency on postural response during standing

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Abstract

We studied the effects of plantar sole vibration using various frequency on postural response during standing. Eight healthy young adults were exposed to 5s periods of plantar sole vibration while blindfolded. Whole-body kinematics, kinetics and EMG of four lower limb muscles were recorded during 5s plantar sole vibration (20, 60, 100Hz). Seperate stimulation of the plantar forefoot zones resulted in whole-body tilts oppositely directed backward and forward, respectively, the amplitude of which was proportional to the vibration frequency. EMG activity of ankle muscles also varied according to the direction of the postural responses. These findings are important for the rehabilitation system of postural balance control and the use of somatosensory information.

하지에 인가한 전기 자극이 신체동요에 미치는 영향

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Effects of Body Sway using Electrical Stimulation on the Lower Limb

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Abstract

In this study, we studied the effect of postural control using electrical stimulation on the lower limb. Seven healthy young adults were given the an electrical stimulation to lower limb muscles when they took one-legged stance and two-legged stance with and without vision on a force platform. Postural response was analyzed by measurement of COP(Center of pressure) sway. During two-legged stance, COP sway toward direction to apply the electrical stimulation. During one-legged stance, the area and distance of COP sway decreased with electrical stimulation to lower limb muscles. We suggest that the electrical stimulation from lower limb muscle could induce stability and instability of balance control according to the stimulus region.

직립자세동안 전정기관 전기자극이 인가되었을 때 신체동요에 대한 영향

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Effects of Body sway using continuous galvanic vestibular stimulation during standing

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Abstract

Galvanic vestibular stimulation(GVS) applied between the mastioids during standing derives body sway. The aim of this study was to characterize the body sway response sinusoidal GVS increase stimulus frequencies and amplitudes. GVS was applied to the skin overlying the mastoid precesses of 3 subjects while they stood force platform with eyes open of closed. The position of the center of pressure(COP) at the feet was recorded force platform. The stimulus conditions included four frequencies(0, 1, 2, and 4 Hz) and three peak amplitudes(1, 2 , and 3 mA). Each subject experienced one trial at each frequency-amplitude pair. The stimuli derived sway in all subjects, as evidenced by changes in the displacement of the COP. sway magnitude increased with increasing stimulus frequency and amplitude.

RFID 기반의 전자페그보드를 이용한 유비쿼터스 원격재활 시스템

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Ubiquitous Telerehabilitation System Using Electronic Pegboard Based on RFID System

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Abstract

This study has proposed a ubiquitous telerehabilitation system using electronic pegboard based on RFID system for the rehabilitation service and occupational therapy. Telerehabilitation provides rehabilitation service to patients in remote locations. Pegboard is a conventional rehabilitation device for the integration of cognition, sensation, and motor function. The proposed system automates the pegboard scoring by detecting the plugging correctness as well as the plugging status with RFID(radio frequency identification). It also aims to increase the patient's interest and the functional intelligence. The system was tested for the automatic capability of the automatic scoring the session. When the pegboard session is finished, the session time is uploaded to the server automatically and therapist at remote location can monitor the result history via web browser and send messages to the patient.

가상현실을 이용한 시각적 피드백제어를 통한 편마비환자의 자기수용감각 이용하는 reaching movement훈련의 효과

조상우[1], 구정훈[1], 강윤주[2], 조윤경[3], 추연지[3], 임수정[3], 이수미[3], 김인영[1], 김선일[1]

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The effect of reaching movement training using proprioception of patients with hemiplegia by manipulating visual feedback using virtual reality

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Abstract

In this study, we confirmed proprioception training effect of patients with hemiplegia by manipulating visual feedback. Five patients with hemiplegia were participated in the experiment. Patients have trained with the reaching task with visual feedback without visual feedback for two weeks. Patients were evaluated with pre-, middle test and post-test with the task with and without visual feedback. In the results, the first-click error distance after the training of the reaching task was reduced when they got the training with the task removed visual feedback. In addition, the performance velocity profile of reaching movement formed an inverse U shape after the training. As conclusion, visual feedback manipulation using virtual reality could provide a tool for training reaching movement by enforcing to use their proprioception, which enhances reaching movement skills for patients with hemiplegic.

밴드 가변형 난청시뮬레이터 개발에 관한 연구

주상익[1], 강현덕[1], 전유용[1], 고민수[1], 길세기[1,2], 이상민[1,2]

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Hearing LoSS Simulator Program with Adjustable Multi-band for Hearing Loss

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Abstract

A hearing loss simulator was developed to simulate hearing impairment for normal hearing listeners It focusing sensori-neural hearing impaired listener's characteristic. Hearing impaired listener has reduced dynamic range and high threshold and reduced frequency selectivity. and has various hearing loss and center frequency. Thus, we developed hearing loss simulator that is available for changeable loss simulation and compensation. and It could switch number of bands and center frequency of each bands according to hearing loss of hearing impaired person. To confirm the evaluation of performance, we takes the experiment.

고령자용 신발 평가를 위한 고령자 보행 특성에 대한 기초 연구

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A study on the characteristics of elderly gait to evaluate elderly shoe

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Abstract

The purpose of this study is to study the characteristics of performance of elderly gait to evaluate elderly shoe. 3D motion capture system which consisted of 6 infrared cameras(Motion analysis Corp., USA) and 2 force plate(AMTI Corp., USA) were used to analyze for gait pattern of both elderly and young control group. The results showed that there are some differences at several variables: walking speed, gait phase rate(stance & swing time rate), range of motion at hip joint angle and center of mass (CoM)-center of pressure (CoP) inclined angle. It is believed that for the elderly, the stability is the important variable especially during walking. Since, CoM-CoP inclined angle is one of the important variable to represent the stability of walking, that variable can be the index for evaluating elderly shoe. For further study, the evaluation of various commercial elderly shoe based these indexes is under progress.

보행재활을 위한 동적균형 훈련이 가능한 양측 대칭형 보행 훈련기기 개발

조용석[1], 허용도[1], 태기식[2], 이현주[3]
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Development of a Bilateral-Symmetric Gait Trainer with Dynamic Balance Training for Gait Rehabilitation

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Abstract

Stroke is one of the most rapidly increasing diseases in elderly Korean persons older than 60, resulting hemiplegia. A special solution should be provided because of its insufficient preventions and treatments. Since generally three month after the initial occurrence of the stroke hemiplegic patients use wheelchairs as a major tool for their locomotions, the gait training is very important in order to recover their gait abilities.

In this study, we developed the system for bilateral gait-assisted training with dynamic balance training for the elderly and patients with gait disorders. The gait training system was composed of driving units and corresponding link systems, foot guides and corresponding accessories, AC motors and their accessories to control gait speed and stride length, electrical control parts, visual-feedback system for dynamic balance training, This study must be successful since it provided a basis to rehabilitate stroke patients in effective and systematic way.

편마비 환자의 보행 시작시 총 압력중심 변화

황선홍, 박선우, 최희석, 김영호
연세대학교 보건과학대학 의공학부

Net Center of Pressure Analysis during Gait Initiation in Patient with Hemiplegia

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Abstract

Gait initiation is a transitional process from the balanced upright standing to the beginning of steady-state walking. Steady-state walking represents the start of repeated gait pattern with steady-state walking speed within one gait cycle. A hemiplegic patient's gait initiation was analyzed using the 3D motion analysis system synchronized with 2 force plates. The first vertex(V1) in the CoP trajectory was plced on the lateral-posterior point from the leading limb side, and the third vertex(V3) was placed on the lateral-anterior point from the trailing limb side for a normal gait initiation. However, V1 was not nearly shown and v3 was placed on the posterior from the trailing limb side. The time and distance from the onset to the toe off(P1) and from the toe off to the initial contact(P2) were analyzed that the mean time was larger and the mean distance was shorter when the affected limb was leading limb. It is expected that this hemiplegic patient's CoP analysis during gait initiation could help to establish the rehabilitation strategies.

한국 고령자의 일상생활 중 다양한 높이에서의 STS(sit-to-stand) 시 관절운동 특성 분석

황성재, 손종상, 김정윤, 김현동, 임도형, 김영호

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Analysis of joint movements during sit-to-stand at various sitting heights in the Korean elderly's daily life

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Abstract

In this study, we analyzed joint movements during STS(sit-to-stand) at various sitting heights(table seat, bath seat, bottom) in the Korean elderly's daily life by using the motion analysis. Five Korean elderly and young were participated in this experiment. Three heights of sitting posture which could represent typical sitting in Korean daily life were chosen as table seat (42cm), bath seat (21cm) and bottom (0cm). As the results, the elderly showed both smaller knee/hip flexion and larger trunk flexion relatively in comparison to the young during table seat STS. The elderly also showed larger dorsiflexion and smaller ROM of knee, hip, trunk compared to the young during bath seat STS. Additionally, the elderly showed larger plantarflexion, hip flexion, smaller knee flexion and trunk flexion during the first half of bottom STS and larger knee flexion, hip flexion and trunk flexion during the second half of bottom STS.

3차원 해면골에 배양된 조골세포의 Oscillatory Fluid Flow induced Shear Stress와 Cyclic Mechanical Strain에 대한 영향 연구

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Pre-Osteoblast Cultured on 3D Trabecular Bone Scaffold under Oscillatory Fluid Flow induced Shear Stress and Cyclic Mechanical Strain

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Abstract

In this study, we investigated effects of oscillatory fluid flow induced shear stress and cyclic mechanical strain on MC3T3-E1 pre-osteoblasts which were seeded in trabecular bone scaffold. To determine the relationship between trabecular bone morphology and osteoblast development, we scanned bone scaffolds and acquired trabecular bone parameters. Then, we compared trabecular bone parameters to ALP(alkaline phosphotase)enzyme activity and prostaglandin E2 protein release after loading. Our results indicated that fluid flow induced shear stress increased both ALP activity and PGE2 release depending on BVF, BS and BVF, Tb.N, respectively, whereas cyclic mechanical strain only increased ALP activity depending on micro strain. Through the results, we suggest that oscillatory fluid flow induced shear stress produced cellular mechanotransduction that is different from cyclic mechanical strain, and fluid flow induced shear stress is more potent mechanical stimulator than cyclic mechanical strain for osteoblast differentiation in trabecular bone explant model.

재주조한 치과용 Ni-Cr 및 Co-Cr 합금의 부식거동

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Corrosion behavior of recasting Ni-Cr and Co-Cr dental casting alloys

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Abstract

Recently, recasting of dental alloys has been performed not only precious dental alloy but also non-precious dental alloy due to the increase in the price of raw materials. In this study, commercial Ni-based alloy and Co-based alloy were used for the preparation according to the three casting protocols (group 1 : 100% new alloy, group 2 : 50% new alloy + 50% once-cast alloy, group 3 : 100% once alloy). Corrosion behavior of dental alloys in 0.9% NaCl solution was studied using Tafel polt method, and elemental analysis was performed by x-ray energy-dispersive spectroscopy (EDS). Group 1 of Ni-based alloy represented the lowest corrosion current density (icorr), whereas corrosion current density (icorr) of group 3 was lower than other two groups at Co-based alloy. Group 1 of Ni-based alloy and group 3 of Co-based alloy were detected the largest amount of Cr and Mo, which are the element of role of corrosion resistance in term of the formation of passive film, by EDS analysis. The corrosion resistance of the two non-precious alloys is in the following order: Co-based alloy > Ni-based alloy.

온열치료온도(42℃)와 체온(37℃) 조건에서 Paclitaxel의 농도 변화에 따른 CRL1888 마우스 종양 세포의 Survival rate에 관한 연구

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Survival rate of CRL1888 Mouse Tumor Cell Line with respect to the Concentrations of Paclitaxel at Hyperthermia temperature(42℃) and body temperature(37℃)

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Abstract

Since the paclitaxel has known as one of the most effective antineoplastic drugs, many efforts were devoted to studying the paclitaxel as therapeutic agents against many diseases such as cancers. In this study, we investigated the Survival rate of CRL1888 mouse cell line using ten different concentrations of Paclitaxel(0, 0.005, 0.025, 0.05, 0.25, 0.5, 1, 5, 10, 25μM) at two different incubating temperatures. i.e. body temperature(37℃) and hyperthermia temperature(42℃). As the concentration of the paclitaxel solution increased, the Survival rate of the CRL1888 mouse tumor cell line was decreased at 37℃, but was constant at 42℃ except 25 μM. All survival rate of the CRL1888 mouse tumor cell line cultured at 42℃ was smaller than one at 37℃ in the equal condition. Therefore, the combined treatment with chemotherapy of Paclitaxel and hyperthermia can inhibit growth of tumor cell effectively and improve the curative effect.

MRS를 이용한 근육유래줄기세포의 지방분화유도시 세포 대사물질 변화에 대한 기초 연구

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Preliminary Study for the Evaluation of the Muscle-Derived Stem Cell Metabolism using MR Spectroscopy

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Abstract

The purpose of this study is to observe cell metabolism with MRS when a MDSCs is differentiated into fat. Three experimental groups used MDSCs that cultured in 3 dimensional system, Group1(fibrin gel), Group2(fibrin+undifferentiated MDSCs: cultured 1day, 1week), Group3(fibrin+ differentiated MDSCs: cultured 1week). The spectrum from each group has been acquired by utilizing vertical-bore 14.1T NMR/MRI with PRESS pulse sequence. Compare to spectrums of group 1, 2 and 3, we analyzed metabolite peaks newly formed during the differentiation of the MDSCs. In the result, the common peaks at 3.7/3.5/1.8/1.22/0.8ppm have been detected at each spectrum. Group 3, cultured MDSCs for 1 week into fat, came out a new peak at 2.6ppm and the increase of lipid peaks were also shown. In this study, therefore, we could observe the metabolite change along with MDSCs differentiation and found the potential possibilities of MRS to evaluate the differentiations of stem cell.

MR 온열치료를 위한 coaxial-slot antenna 가열코일의 컴퓨터 모의실험 및 온도 측정

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Simulation and temperature measurement of the coaxial-slot antenna for MR hyperthermia

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Abstract

Hyperthemia therapy combined with Magnetic Resonance Imaging (MRI) has several advantages for the treatment of small tumor. High Frequency Ultra Sound (HIFU) method commonly used for heating source. HIFU method, however, has some drawbacks. For this, coaxial-slot antenna driven by 2.45GHz μ-wave was proposed. The coaxial-slot antenna was designed by computer simulation. To optimize the design of antenna, reflection parameter(S11) and SAR distribution in muscle model at the center frequency, 2.45㎓, were analyzed using HFSS s/w. The temperature was measured to test heating performances of hand-made coaxial-slot antenna based on the distance from the heating point and power using agarose gel phantom.

The SAR distribution has similar trends on both computer simulation and temperature measurement experiment. The SAR value is 2.0×10^2(W/kg) at the slot and 1.9×10(W/kg) at ±10mm far from the slot. This study suggest that coaxial-slot antenna is a useful heating source for the hyperthemia therapy.

Micro-CT에서 x-ray grid가 image quality에 미치는 효과

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The effect of an x-ray grid on micro-CT images

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Abstract

Cone beam micro-CT imaging is capable of 3D imaging with large volume coverage. It means that a cone beam micro-CT is more prone to scatter artifacts than a fan-beam micro-CT. X-ray scattering generates contrast reduction, image artifacts and CT-number anomaly in the reconstructed images. This research reports the effect of anti-scatter x-ray grids on image quality in micro-CT. The performances of anti-scatter x-ray grids were evaluated with a contrast phantom and a resolution phantom. Grids reduce cupping artifacts about 5%. However, they decrease CNR about 10-13.7%.

직류 모터 제어를 통한 자기공명영상용 대동맥형 맥동 혈류 모델의 제작

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Development of pulsatile aortic flow model for MRI using DC motor control unit

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Abstract

We developed an aortic pulsatile flow model for MR phase-contrast imaging. The model consisted of continuous flow pump, main duct, collateral duct, and stop-cock valve. The valve was connected to motorized mechanical control module. By opening and closing of the valve, pulsatile flow could be generated. When motor was activated, the valve was opened and systolic flow was generated. The motor stopping time correlated with diastolic flow phase. Under various setting conditions of valve control module, MR phase-contrast based flow velocimetrty was performed and analyzed using commercial program (ReportCard, GE Healthcare, Milwakee, U.S.A). The measured flow pattern shown as time-velocity curve, was correlated with the preset ideal flow pattern based on the setting of valve control module.

학생논문경연

고속 광 스펙트럼을 이용한 뇌조직 신경 활동 측정

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Fast optical spectrum measurement of neural activity in brain tissues

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Abstract

In recent years, non-invasive functional brain imaging techniques have been widely utilized in neuroscience and neural engineering. However, the conventional methods such as the functional magnetic resonance imaging and diffuse optical tomography have shown delays as large several seconds, due to the neuro-vascular coupling. It is therefore desired to develop a new fast optical recording method. As a first step to such a goal, we studied the near-infrared transmission spectrum during neural activation. We developed a new high-speed near-infrared spectrometer with over one thousand spectrum lines per second. and used it to obtain fast transmittance spectrum from rat hippocampal brain slice. The result is an fast changing spectrum highly correlated with neural activity. This finding will be applied to development of a novel optical technique for noninvasive and fast monitoring of human brain activity.

완화된 배열 부분집합 정칙화에 의한 컴프턴 카메라 재구성의 완화파라미터 특성

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A Study of Characteristics of the Relaxation Parameter in Compton Camera Reconstruction by Relaxed Ordered Subsets Regularization

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Abstract

Recently, there have been considerable interests in developing Compton cameras for nuclear medicine, which can improve spatial resolution as well as detector efficiency. However, it has been of a difficult problem to reconstruct an image with good accuracy from Compton scattered conical projection data. Here we investigate the block sequential regularized expectation maximization (BSREM) algorithm for Compton camera reconstruction, which is a relaxed ordered subsets algorithm and have proven useful in conventional emission tomography such as SPECT and PET. Since the convergence of the BSREM algorithm is controlled by the relaxation parameter, it is important to choose a right relaxation scheme for better performance. In this paper we perform an experimental study of relaxation in the convergence and quality of image reconstruction for Compton imaging and show that image quality as well as convergence speed can be greatly improved by properly choosing the relaxation parameter.

레이저 파장에 따른 지방용해 효과에 관한 연구

강인혜, 김수정, 박하나, 신은정, 여민아, 이연의, 윤종인

대구가톨릭대학교 보건과학대학 의공학과

A Wavelength Dependence Study of Laser-Assisted Lipolysis Effect

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Abstract

In this study, wavelength dependence measurements of laser lipolysis effect were performed using different lasers at 1064, 1320, and 1444 nm wavelengths that are currently used in the clinic. The radiant exposure was from 20 W to 80 W with the same parameters (Beam Diameter = 600 um, Peak Power = 200 mJ, Pulse frequency = 40 Hz) for all the lasers. After the laser irradiations, the ablated craters and mass loss were measured using a spectral optical coherence tomography and a micro-balance, respectively. The results were also compared with a numerical simulation using monte carlo modeling technique. In conclusion, a 1444 nm wavelength laser effectively ablated fatty-tissue when compared with other laser wavelengths.

적응 윈도우를 사용한 Laser Speckle Contast Analysis(LASCA)

진호영, 신현출

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Laser Speckle Contrast Analysis Using Adaptive Window

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Abstract

This paper proposes a new image processing method for laser speckle, adaptive windowing laser speckle contrast analysis (aLASCA) that adaptively processes laser speckle images in the spatial. Conventional fixed window based LASCA has shortcoming in that it uses the same window size regardless of target areas. Inherently laser speckle contains undesired noise. Thus a large window is helpful for removing the noise but it results in low resolution of image. Otherwise a small window may detect micro vascular but it has limits in noise removal. To overcome this trade-off, we newly introduce the concept of adaptive windowing to conventional laser speckle image analysis. We have compared conventional LASCA and its variants with the proposed method in terms of image quality and processing complexity

약물에 의한 간질 유발시 마우스 뇌에서 근적외선 분광법과 뇌전도의 동시측정

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A Simultaneous NIRS and EEG Study During Pharmacologically Driven Seizure in the Mouse Brain

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Abstract

We measured hemodynamic and electrical responses during epileptic event which was pharmacologically driven by GBL (Υ-Butyrolactone) and 4AP (4-Aminopyridine) using NIRS and EEG simultaneously. To the best of our knowledge, we firstly set up the multi-channel, single distance NIRS system along with bipolar electrode EEG system in the mouse brain. We analyzed various hemodynamic responses including systemic low-frequency signal and rhythmical fluctuation signal. Our results show that the GBL induces global hemodynamic responses (4 out of 6 mice) over the whole brain while 4AP causes localized responses (4 out of 6 mice) in the systemic change signal. The rhythmical fluctuation signals were also quite different between the two agents. When the epileptiform discharges occurred in the GBL injected mice, vasoconstriction (4 out of 6 mice), wash-out (2 out of 6 mice), no hemodynamic signal (2 out of 6 mice) and oxygen decreasing responses (2 out of 6 mice) were observed. Typically, the phase relationship between HbO_2 and Hbr is in-phase during vasoconstriction and out-of phase during other events. In case of the 4AP, we observed wash-out (4 out of 6 mice), oxygen decreasing (4 out of 6 mice) and no hemodynamic responses (1 out of 6 mice) which phase relationships were out-of phase. Our finding suggest that the neurovascular coupling results in diverse responses such as vasoconstriction, no signal, oxygen decreasing and wash-out in hemodynamic responses during seizure.

Micro-CT 영상에서 Fuzzy Algorithms을 사용한 Bone Parameters 측정

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Measurement of Bone Parameters from Micro-CT Images using Fuzzy Algorithms

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Abstract

Osteoporosis a disease of bone that leads to an increased risk of fracture is an important issue in medical field. In the osteoporosis literature, different bone parameters like bone connectivity density, bone volume ratio are believed to be an important mechanics-related architectural measure. Accurate measurement of bone parameters is of significant interest to assess the mechanical strength of bone. Fuzzy algorithms have been introduced into bone parameter calculations to secure high fidelity. Bone parameters were calculated from micro-CT images of a large bone and again calculated from the images of small region of bone taken from the large bone.

자기 공명 위상 대조 영상기반의 유속 측정과 벽면 전단 응력 측정의 검증

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In vitro verification of MR Phase contrast based flow velocimetry and Wall Shear Stress measurement

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Abstract

In this paper, we developed and verified a technique to measure pixel-by-pixel flow velocity and wall shear stress (WSS) from phase-contrast Magnetic Resonance Imaging (MRI). The velocity was calculated using signal intensity and Velocity Encoding (VENC) value as input variables. The calculated mean velocity was verified using expeimentally measured physical mean velocity and was compared with the results of commercial velocimetry program (ReportCard, GE Healthcare, Milwakee, U.S.A). Using the velocity information, WSS was calculated. The calculated mean WSS was verified based on physically measured mean WSS. In addition, using two data sets from curved flow model, the WSS was measured. The calculated velocity showed significant correlation with physically measured values (R^2=0.85). The result was better than the ReportCard (R^2=0.75). The calculated mean WSS revealed significant correlation with physical values (R^2=0.95). The curved flow model showed statistically significant shifting of peak velocity and WSS zones toward outbound of the flow.

Preliminary Study on the Novel MR Thermal Mapping using Self-developed Phase Unwrapping Method

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Abstract

The purpose of this study is to investigate the feasibility and accuracy of chemical shift based magnetic resonance (MR) thermal mapping utilizing the self-developed phase unwrapping (PU) algorithm for monitoring hyperthermic procedures. The experiment was performed on an agarose gel phantom using a custom-made thermoregulating water pump that generated heat to the phantom whilst temperature variation was observed with thermocouple. The self-developed PU program is known as center array-sequencing algorithm that was implemented on the wrapped phase images prior to map the temperature distribution on the subject. As the temperature difference is directly proportional to the phase difference map, the absolute temperature could be estimated from the addition of the computed temperature difference with the ambient temperature. This approach demonstrated that MR temperature monitoring was improved by integrating the PU method that significantly removed the phase wrapping artifacts which may corrupt MR images. Further studies include the assessment of reliability and confirmation of these results ex vivo.

생체신호 기반의 틸팅 열차 승차감 평가 방법 연구

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Ride comfort Evaluation based on Bio signal Analysis for Tilting Train

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Abstract

Transportation by train has numerous advantages. Trains are highly energy efficient, eco-friendly, safer than normal roads, and they help people to arrive at their destinations on time. Recently, the value of ride comfort, which is only limited to road transportation, has become an issue with train travel as a means for it to stay competitive with other types of transportation. In particular, in the development of the Korean high-speed railroad business, the ride comfort enhancement technology of a tilting train is an important issue. International standards of ride comfort have been formulated, such as UIC13 and ISO2631. Although Korea has Korean standards such as KS R9216, these standards mainly concern physical parameters such as vibration and noise. Therefore, recently in the area of ride comfort, the introduction of Bio-signal parameter techniques has begun, as it has in Japan and in many developed countries in Europe.

편마비 환자를 위한 상지 재활훈련시스템 개발

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The development of upper extremity rehabilitation training system for hemiplegic patients

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Abstract

Existing therapy and orthosis for rehabilitation of upper arm have some shortcomings such that orthosis can't help patient's motion but it just supplies, patient has to go to hospital for therapy and patient can't reflect his will in therapy. Because of these reasons, upper arm rehabilitation system was developed, which could increase patient's strength and make patient train by oneself. To make the training system, motor and EMG sensor with orthosis were used so that orthosis could move actively and give load to patient. EMG sensor was used for feedback to reflect patient's will and the rotational potentiometer was used to get the information about joint angle. Orthosis made upper arm's flexion and extension, and used EMG signal. For rehabilitation, orthosis made users exercise by giving proper load, or made involved arm mimic uninvolved arm's motion. As the developed system could reflect patient's will, we expect that it would be applied to improve rehabilitation effects.