2020
대한의용생체공학회
하계 온라인 심포지엄
Online Meetup of KOSOMBE 2020

2020년 7월 23일(목) ~ 24일(금)

대한의용생체공학회
The Korean Society of
Medical & Biological Engineering

인사말

대한의용생체공학회 회원님께,

COVID19 사태가 지속되고 있는 어려운 상황에서 다들 건강히 지내시기를 기원합니다.

춘계학술대회를 개최하지 못하게 된 상황에서 하계심포지움 Online Meetup KOSOMBE 2020을 개최하게 된 것을 기쁘게 생각합니다.

학회는 학문교류를 기대하시는 여러 회원님의 기대에 부응하고자 간소하지만 필요한 지식을 전달하는 장이 될 수 있도록 심포지움을 준비하였습니다. 튜토리얼 세션은 특히 의공학에 대한 전반적 이해를 필요로하는 학생회원들의 지적 빈칸을 채워줄 수 있도록 하였으며, 우수 신진공학자 세션을 통하여 첨단 최신지견에 대한 정보를 전해드릴 수 있도록 준비하였습니다.

그러나 시간적 여유가 부족한 것과 처음 시도해 보는 온라인 학술대회로 인한 불편함이 생길 수도 있으니 많이 이해하여 주시기 바랍니다.

온라인 심포지움을 위해서 노력해 주신 학술이사님과 학술위원님께 다시 한번 감사를 드리며 학술대회를 통하여 지적교류와 배움의 갈망을 해결하는 장이 될 수 있었으면 합니다.

감사합니다.

대한의용생체공학회장 **최 진 욱** 배상

인사말

존경하는 대한의용생체공학회 회원님들께,

코로나19 사태로 인해 올해 상반기에 예정되었던 대한의용생체공학회 춘계 학술대회가 취소된 가운데, 학문적 소통과 융합의 장을 유지하고 안정적인 학회 운영을 지원하고자 7월 23일부터 24일까지 “2020 대한의용생체공학회 하계 온라인 심포지엄”을 개최하게 되었습니다. 학회 역사상 처음 치르는 온라인 심포지엄에 많은 관심과 성원을 보내주셔서 진심으로 감사드립니다.

올해 학술위원회는 위원회의 효율적인 운영과 내실있는 프로그램 구성을 위해 의공학의 다양한 연구 분야를 뇌공학, 생체계측, 의료영상, 바이오칩, 의광학, 생체소재, 생체역학, 의료기기 및 임상의 여덟 개 분과로 나누고 각 분과별 분과장 및 분과위원을 두어 새롭게 출발을 하였습니다. 춘계학술대회가 취소되는 아쉬움을 뒤로 하고 이번 심포지엄에서 학술위원회는 우리나라 의료영상 기술 발전에 많은 공헌을 하고 계신 한국표준과학연구원(KRISS) 김기웅 박사님의 초청강연과 분과별 튜토리얼 세션, 의공학 교육세션, 우수 신진 의공학자 세션을 준비하였습니다. 또한 E-부스를 통해 의공학 관련 기업과 연구소를 소개하는 자리도 마련하였습니다. 김기웅 박사님을 비롯하여 발표를 수락해 주신 모든 연자님과 참여 전시업체에 깊은 감사를 드립니다.

하계 온라인 심포지엄이 성공적으로 진행될 수 있도록 회원 여러분의 적극적인 참여와 협조를 부탁드리며, 코로나19 사태가 진정되어 추계학술대회에서는 직접 회원님들을 뵐 수 있기를 기대하겠습니다. 모든 회원님들의 안녕과 건승을 기원합니다.

감사합니다.

대한의용생체공학회 학술이사 일동 배상

제27대(2020년) 임원진 명단

직책	성명	소속
명예회장	김희찬	서울대학교
회장	최진욱	서울대학교
수석부회장	김동욱	전북대학교
부회장	정동근	동아대학교
	이레나	이화여자대학교
감사	김법민	고려대학교
	노정훈	부산대학교
총무이사	안원식	경희대학교
	최영빈	서울대학교
재무이사	전상범	이화여자대학교
	신항식	전남대학교
기획이사	남윤기	KAIST
	이정현	경북대학교
학술이사	정병조	연세대학교
	변경민	경희대학교
	임창환	한양대학교
	유홍기	KAIST
편집이사	이재성	서울대학교
	남기창	동국대학교

직책	성명	소속
교육이사	조성보	가천대학교
	윤용현	대림대학교
편찬이사	양윤석	전북대학교
	최진승	건국대학교
	서종모	서울대학교
	박희준	계명대학교
정보전산 이사	기재홍	연세대학교
홍보이사	김경환	연세대학교
	정윤경	인제대학교
산학협력 이사	서수원	대구경북첨복
	손영돈	가천대학교
	송영준	오송첨복
	박성빈	원주의료기기
국제협력 이사	김철홍	포항공과대학교
	신현정	KAIST
융합특임 이사	김인영	한양대학교
	김성은	고려대학교
	조영호	국립암센터
	김경아	충북대학교

2020 학술위원회 명단

학술이사	정병조	연세대학교
	변경민	경희대학교
	임창환	한양대학교
	유홍기	KAIST
위원	성준경	고려대학교
	장동표	한양대학교
	조일주	KIST
	김도원	전남대학교
	김성필	UNIST
	구정훈	계명대학교
	김형식	건국대학교
	신터전	서울대학교
	오동인	경희대학교
	이승민	국민대학교
	장원두	동명대학교
	염정열	고려대학교
	박형원	성균관대학교
	오세홍	한국외국어대학교
	이종호	서울대학교
	양세정	연세대학교
	윤창한	인제대학교
	박수현	중앙대학교
	최성용	한양대학교
	천홍구	고려대학교
	최연호	고려대학교
	정아람	고려대학교

위원	조성보	가천대학교
	정세훈	인제대학교
	최명환	서울대학교
	엄경식	부산대학교
	김필한	KAIST
	윤종인	대구가톨릭대학교
	최승호	연세대학교
	하진용	세종대학교
	박지호	KAIST
	황석원	고려대학교
	윤대성	고려대학교
	주진명	UNIST
	정윤경	인제대학교
	임도형	세종대학교
	태기식	건양대학교
	박중열	중앙대학교
	김성민	울산대학교
	구승범	KAIST
	주세경	아산병원
	박성민	포항공과대학교
	남승윤	부경대학교
	유형석	한양대학교
	김종진	전기연구원
	이병훈	인천대학교
	임한웅	한양대학교병원

2020 대한의용생체공학회 하계 온라인 심포지엄

DAY1 (7/23, Thur)

시간	Room A	Room B
PM1:30~	개회식	
2:00~3:00	Tutorial Session 1 (뇌공학)	교육위원회 Session 1
3:00~4:00	Tutorial Session 2 (생체계측)	
4:00~4:30	Coffee Break	
4:30~5:30	Tutorial Session 3 (의료영상)	우수 신진 의공학자 Session 1
5:30~6:30	Tutorial Session 4 (바이오칩)	

DAY2 (7/24, Fri)

시간	Room A	Room B
PM1:00~2:00	초청강연 – KRISS 김기웅 박사	
2:00~3:00	Tutorial Session 5 (의광학)	교육위원회 Session 2
3:00~4:00	Tutorial Session 6 (생체소재)	
4:00~4:30	Coffee Break	
4:30~5:30	Tutorial Session 7 (생체역학)	우수 신진 의공학자 Session 2
5:30~6:30	Tutorial Sssion 8 (의료기기/임상)	
	폐회식	

개회식

사회자: 정병조(연세대)

초청강연

좌장: 임창환 (한양대)

- **김기웅** 한국표준과학연구원 양자자기이미징팀 팀장

  Hyperpolarization for novel medical imaging applications

Tutorial Session 1 (뇌공학)

좌장: 성준경 (고려대)

- **조일주** 한국과학기술연구원 바이오마이크로시스템연구단 단장

  뇌신호 측정을 위한 실리콘 전극

Tutorial Session 2 (생체계측)

좌장: 구정훈 (계명대)

- **지영준** 울산대학교 의공학과

  의용계측: 범위와 방법의 변화

Tutorial Session 3 (의료영상)

좌장: 염정열 (고려대)

- **이정우** 광운대학교 전자공학과

  B-mode 초음파 영상기술의 이론 및 응용

Tutorial Session 4 (바이오칩)

좌장: 최성용 (한양대)

- **김영필** 한양대학교 생명과학과

  바이오센서/칩: 모방과 진화에서 의공학적 응용까지

Tutorial Session 5 (의광학)

좌장: 최명환 (서울대)

- **김준기** 울산대학교 의과대학

  의광학 내시경

Tutorial Session 6 (생체소재)

좌장: 박지호 (KAIST)

- **박지호** 한국과학기술원 바이오및뇌공학과

  생체재료와 나노의학

Tutorial Session 7 (생체역학) 좌장: 임도형 (세종대)

- **김봉주** 서울대학교 치과병원 치의생명과학연구원/중개임상시험지원센터

  인체 삽입형 의료 기기 생체역학 연구

Tutorial Session 8 (의료기기/임상) 좌장: 주세경 (서울아산병원)

- **임채헌** 울산대학교 의과대학 생리학교실

  Physiology and health care device

우수 신진 의공학자 Session 1 좌장: 변경민 (경희대)

- **윤종희** 아주대학교 물리학과

  초분광 영상을 이용한 식도암 조기진단 기술 개발

- **구태윤** 한국과학기술원 의과학대학원

  Engineering mechanical properties of human tissue specimens for large-scale molecular phenotyping

- **권보미** 세종대학교 기계공학과

  미세유체칩 내 세포미세환경 조절을 통한 혈관내피세포 기능장애 유발

- **정재웅** 한국과학기술원 전기및전자공학부

  Soft Wireless Optofluidic Neural Interface Technology

우수 신진 의공학자 Session 2 좌장: 유홍기 (KAIST)

- **구자현** 고려대학교 바이오의공학부

  Biodegradable neuro-electrode for next deep brain stimulation

- **동서연** 숙명여자대학교 IT공학전공

  Effect of daily mental stress on bio/brain signals

- **유재석** 대구경북과학기술원 로봇공학전공

  Super-resolution ultrasound imaging: Beyond the acoustic diffraction limit

- **이주헌** 한양대학교 생명나노공학부

  Biomimetic Filamentous Phage based System Design

교육위원회 Session 1 좌장: 조성보 (가천대)

- **정동근** 동아대학교 의과대학 의공학교실
  기초의학 및 의공학
- **윤용현** 대림대학교 의공융합과
  의용전자공학

교육위원회 Session 2 좌장: 윤용현 (대림대)

- **심은보** 강원대학교 기계의용공학과
  의용기계공학
- **남기창** 동국대학교 의과대학 의공학교실
  의료기기

폐회식 사회: 정병조 (연세대)

2020 대한의용생체공학회 하계 온라인 심포지엄 참여안내

1. 온라인 심포지엄 공식 홈페이지

- https://online.the-kin.kr

2. 홈페이지 접속

- 2020년 7월 23일(목) 낮 12시부터

3. 로그인 방법

- 아이디 : 사전등록 시 입력한 이메일 주소
- 패스워드 : 휴대폰 전화번호 뒷 4자리

4. 주요 안내사항

- 개별 아이디는 한 사람만 사용 가능합니다. 중복 사용 시, 기존 접속은 차단됩니다.
- 질문은 Question 메뉴를 이용하여 텍스트로 입력하고 좌장이 선택하여 대신 질문합니다.
- 발표는 사전 제작 영상이며, 질문에 대한 답변은 발표자가 직접 실시간으로 진행합니다.
- E-부스 참관 시, 방명록을 남겨야 해당 업체 사이트에 방문한 것으로 인정됩니다.

Kiwoong Kim
Ph. D
Principal Research Scientist, Head, Korea Research Institute of Standards and Science (KRISS)
Professor, Chief Department Professor, Dept. of Medical Physics, University of Science and Technology (UST)

Hyperpolarization for Novel Medical Imaging Applications

Abstract

Currently, there were lots of efforts to find novel contrasts or applications in nuclear magnetic resonance imaging with sensitive magnetic field sensors such as superconducting quantum interference devices (SQUID), optically pumped magnetometer (OPM), and diamond nitrogen vacancy (DNV) centers. In such trials, the polarization of a sample is generally not enough due to the limitation in use of a strong polarization magnetic field under an operation condition of a sensitive sensor and in field cycling interference with a magnetic shielding structure in micro-tesla applications.

Hyperpolarization can be an effective solution in order to increase the signal and spatial resolution in the imaging technology. In this presentation, we introduce hyperpolarization techniques and applications in ultra-low field nuclear magnetic resonance imaging (ULF-MRI). The scope of talk consists of Overhauser dynamic nuclear polarization (O-DNP), the signal amplification by reversible exchange (SABRE) technique with para-hydrogen, and optical DNP.

Finally, we introduce a novel optical room-temperature hyperpolarization application with nano-diamonds.

Brief Biosketch

Kiwoong Kim Dr. Kiwoong Kim is the head of Quantum Magnetic Imaging team in Korea Research Institute of Standards and Science (KRISS), Daejeon and a professor in the Department of Medical Physics at University of Science and Technology, Daejeon. He received his B.S., M.S., and Ph.D. degrees in Physics from the Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea, in 1995, 1997, and 2002, respectively. In 2006, 2012, and 2018 he had been a research associate with Princeton University, Princeton, NJ, and an invited guest scientist in Physikalisch-Technische Bundesanstalt, Berlin and Kyoto University, Kyoto, respectively. His research interests are based on quantum measurement of magnetic fields by using SQUID, atomic magnetometer, diamond nitrogen vacancy, mechanical cantilever, etc. He has always been pursuing novel detection principles like magnetic resonance force microscopy (MRFM), micro-Tesla NMR/MRI, biomagnetic resonance (BMR), MEG, MCG. In conjunction with high-end signal processing/analysis, inverse problem solving, machine learning, clinical diagnoses, and electrophysiological modeling he expended his research area to biomagnetism and human perception study.

Il-Joo Cho
Principal Research Scientist
Korea Institute of Science and Technology

Silicon Probes for Studying Neural Circuits In-vivo

Abstract

Investigation and modulation of neural activities in-vivo at the cellular level are very important for studying functional connectivity in a brain. There have been several methods for recording neural signals in-vivo. However, the previous methods could not provide the capability of recording a large number of neural signals with minimal tissue damage. Recently, silicon neural probes with stimulation capabilities have been introduced, and they provided an opportunity for studying neural activities at a specific region in the brain using various stimuli. Also, the electrode density is higher than the previous recording electrode, which enables the recording of neural signals from a large number of neurons simultaneously. In this lecture, we will review the method of using the MEMS-based neural probe as well as the various applications of MEMS-based neural probes will be introduced.

Brief Biosketch

PROFESSIONAL EXPERIENCE

- Head of Center for BioMicrosystems, Brain Science Institute, KIST (2018.3~Present)
- Principal Research Scientist, KIST (Seoul, Korea) (2016.3~Present)
- Senior Research Scientist, KIST (Seoul, Korea) (2010.9 ~ 2016.2)
- Visiting Research Scientist, Dept. of EE University of Michigan (Ann Arbor, MI) (2008.7~2010.8)
- Research Fellow, Dept. of EE University of Minnesota (Minneapolis, MN) (2007.8~2008.6)
- Senior Research Engineer, LG Electronics Institute of Technology (Seoul, Korea) (2004.8~2007.8)

EDUCATION

- Ph.D of Electrical Engineering at KAIST, Korea (2000.3 ~ 2004.8)
- M.S. of Electrical Engineering at KAIST, Korea (1998.3 ~ 2000. 2.)
- B.S. of Electrical Engineering at KAIST (1994.3 ~ 1998. 2.)

지 영 준, Ph.D.
울산대학교 전기공학부 의공학전공

의용계측, 범위와 방법의 변화

Abstract
본 발표는 '의용계측', '생체계측', '의용생체계측'의 구체적 지식을 전달하는 것이 아니고, 분야 자체에 대한 이야기, 즉 의용계측을 공부할 때의 범위와 방법에 대한 이야기이다. Medical Instrumentation(의용계측) 이라는 용어로 국내에 소개된 이후에 많은 의공학 연구개발의 방법론으로, 그리고 의료기기 산업을 지탱하는 기술 분야로서 역할을 해 왔으나 2020 년 현재, 그 범위와 공부 방법에 대한 변화의 요구가 있다. '계측', 'Instrumentation'이라는 단어에 드러난 의미를 좁게, 혹은 넓게 해석하여 의용생체계측 공부 목적에 따른 공부 방법을 제안한다.

Brief Biosketch

서울대학교 공과대학 제어계측공학과 공학사(1991)

서울대학교 대학원 협동과정 의용생체공학 / 공학 박사(2005)

1996 - 1998 (주) 메디슨

1998 - 2004 (주) 엠지비 엔도스코피

2009 - 현재 울산대학교 의공학과

Jungwoo Lee
Professor
Department of Electronic Engineering,
Kwangwoon University

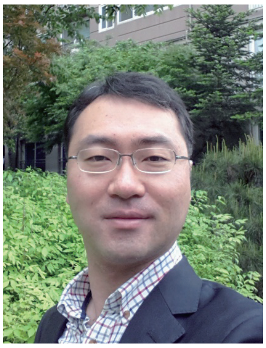
Principles of Ultrasound B-mode Imaging

Abstract

Ultrasound imaging has been used as the first line of medical diagnosis prior to other imaging methods. This imaging modality is real-time, portable, relatively inexpensive, and radiation-free, as compared to alternate imaging procedures such as computed tomography (CT) or magnetic resonance imaging (MRI). In particular, modern ultrasound imaging has mostly been carried out via pulse echo approach with brightness mode (B-mode) display, and useful for measurement of anatomical dimensions and detection of minute change in tissue texture. Clear representation of anatomical structures shown in B-mode images is a first step towards accurate diagnosis for appropriate patient treatment. Intricate interactions between ultrasound and biological tissue, otherwise, may often lead physicians to false recognition of acquired images. In order to correctly produce B-mode images, therefore, it is of great importance for ones to understand fundamental principles and technical elements regarding ultrasound image formation. To that end, this lecture attempts to provide an insight into medical ultrasound physics to a broad audience from interdisciplinary backgrounds. Basic concepts behind sound propagation, scattering from organ boundary, echo generation, etc are presented along with a number of B-mode examples for better understanding. In addition, typical B-mode artifacts and their enhancement techniques for correcting spurious errors are discussed.

Brief Biosketch

Professor, Department of Electronic Engineering, Kwangwoon University (Sep 2011 ~ Present)
Research Associate, USC NIH Ultrasonic Transducer Resource Center, CA, USA (Sep 2006 – Aug 2011)



Young-Pil Kim
Ph.D. / Professor
Dept. of Life Science, Hanyang University
ypilkim@hanyang.ac.kr
https://sites.google.com/site/ypkimlab/

바이오센서/칩: 모방과 진화에서 의공학적 응용까지

Abstract

Biosensors/biochips are garnering substantial interest due to their potential to provide physiological and quantitative information via bioreception and transduction of various targets in biomedical and industrial applications. Here I focus on the concept, a short history, and future trend of biosensors/biochips, together with advances in the biomimetic detection system including vision, taste, and olfactory systems. Accurate and reliable sensing of physiological information using integrated biosensor/biochip technologies would have a broad impact on our daily lives.

Brief Biosketch

• Education
1992-1996 : Dept. of Biology, Hanyang University (B.S.), Korea
1998-2000 : Dept. of Life Science, Hanyang University (M.S.), Korea
2004-2008 : Dept. of Biological Sciences, KAIST (Ph. D.), Korea

•Professional Positions
2008-2011 : Postdoctoral Affiliate, School of Medicine, Stanford University, USA
2017-2018 : Visiting Professor, Dept. of Bioengineering, U. of Washington, USA
2011-present : Dept. of Life Science, Hanyang University

• Research Field and Interests
Nanobiosensor, cancer-targeting imaging, aptamer, and photodynamic therapy

Jun Ki Kim
Assistant Professor
Biomedical Engineering Research Center, Asan Institute for Life Science, Asan Medical Center

Overview of Endoscopy

Abstract

Over the past few decades, the endoscopy has become a fundamental clinical approach for non-invasive screening and diagnosis of various diseases. This device is broadly accepted as a tool for visualizing the various inner organs and tubular organs such as oral cavity, liver, bladder, kidney, respiratory tract, the urinary tract, the uterus, and the gastrointestinal tracts. Now, endoscopy has expanded the range of their functions including not only longitudinal observation in non-invasive methods, but also simple medical procedures, biopsy, local therapy or minimally invasive robotic surgery. Despite its utility for diagnosis, clinical endoscopy has a few limitations in terms of size, resolution and functions. In addition, each organ must be provided with a specially designed endoscope such as laryngoscope, laparoscope, cystoscope, esophagoscope, bronchoscope and colonoscope. Advancements in micro-optics and fiber optics technology have paved way in enhancing its features and removing such physical constraints, whilst maintaining high optical performance. In this tutorial, the history, type, purpose of the endoscope will be explained and how to configure it extensively. Besides, various types of advanced endoscopic technologies are introduced for carrying out minimally invasive imaging procedures and providing diverse functions in basic and preclinical / clinical studies.

Brief Biosketch

Jun Ki Kim is an Associate Professor in Asan Institute for Life Sciences, Asan Medical Center, and Department of Convergence Medicine, University of Ulsan College of Medicine. He received his BS degree in aviation electronics from Korea Aviation University, and the MS and Ph.D. degree in engineering of information and communication from GIST, Korea. He conducted postdoctoral research at Fraunhofer institute in Jena, Germany and MGH, Harvard Medical School in Boston, USA. His research interest includes micro/nano-optics based on the various optical elements as well as biomedical applications such as endoscope, image guided surgery and intervention surgical devices.

Park, Ji Ho
Associate Professor
KAIST

Biomaterials and Nanomedicine

Abstract
In this tutorial, I will introduce the basic concept of biomaterials, their types and functions, and their applications in the fields of biomedicine. In addition, I will briefly introduce nanomedicine that improves the therapeutic effect by efficiently delivering drugs to diseased sites using nano-sized biomaterials. Lastly, I will discuss the fields in which biomaterials can contribute in the future.

Brief Biosketch
Ji-Ho Park is Associate Professor of Bio and Brain Engineering at Korea Advanced Institute of Science and Technology (KAIST) South Korea. He holds Affiliate appointments in the Graduate School of Medical Science and Engineering, and the Institute of Health Science and Technology at KAIST. He received a B.S. degree in Materials Science and a M.S. degree in Medical Science from Yonsei University (South Korea). He then moved to the USA and received his Ph.D. degree in Materials Science from University of California, San Diego under the direction of Professor Michael Sailor in 2009. He joined the faculty in the Department of Bio and Brain Engineering at KAIST in 2010, after postdoctoral studies at University of California, Berkeley under Professor Peidong Yang. He was promoted to Associate Professor in 2015. He is the recipient of Young Investigator Award from the Korean Society of Medical and Biological Engineering. He is the author of over 100 research publications in journals including Nature Materials, Nature Nanotechnology, Nature Communications, and PNAS, in subjects related to therapeutic bioengineering and drug delivery. He has 30 patents or patents pending.

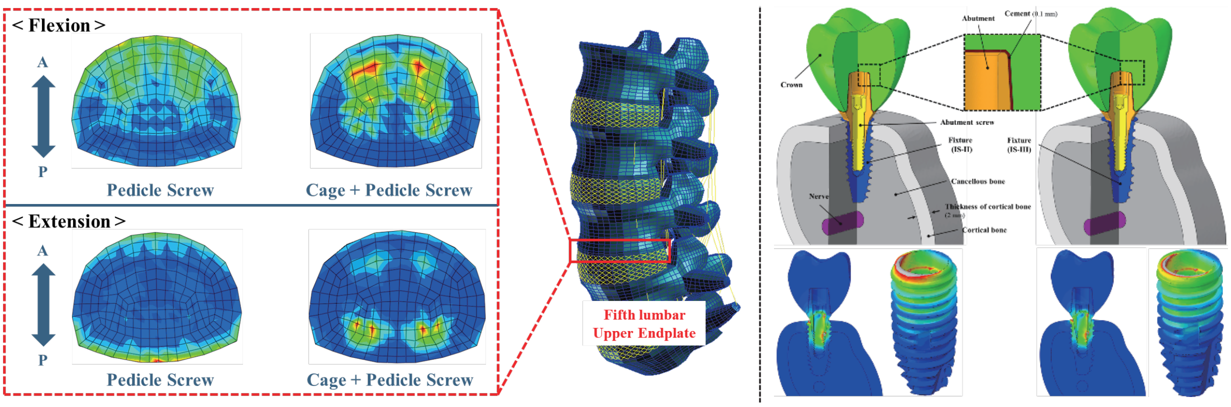
Bongju Kim
Associate professor (Research)
Dental Life Science Research Institute, Seoul National University Dental Hospital
Clinical Translational Research Center for Dental Science, Seoul National University Dental Hospital

Biomechanical analysis of medical devices using finite element method

Abstract

In the development process of medical devices, biomechanical analysis by finite element method (FEM) have been contributed the design of product on orthopaedical and dental fields. The FEM is a numerical method used to solve boundary value problems. FEM results typically predict device performance after surgical procedure for the determination of medical device design. A user may leverage results from such an analysis to evaluate device performance for improvement and optimization based on the comprehension of stress and strain.

Brief Biosketch



생체신호와 의료기기는 뗄래야 뗄수 없는 사이이다. 생체신호는 결국 인체 생리학 기반에 의해 그 의미를 찾을 수 있으며 코호트 연구를 통해 임상적의미를 확정 짓게 된다. 현재 의료기기는 임상현장에서 사용하는 의료기기를 개선하거나 새로운 방법으로 취득하는 데 집중하고 있는 상황이다. 이러한 상황은 새로운 생체신호를 찾는 큰 장애요인 중 하나이다. 생체신호 발굴은 곧 새로운 의료기기의 개발로 이어질 수 있으나 이를 개발하기 위해서는 이를 확인할 수 있는 의료기기의 개발이 필요하다. 즉 의료기기 개발과 생리학 기반의 새로운 생체신호 발굴은 서로 같이가야 하는 동반자 관계라 할 수 있다. 생리학적 지식 체계 기반의 인체신호 발굴과 이를 효율적으로 측정할 수 있는 의료기기의 동반자적 연구가 필요한 시점이다.

윤 종 희
조교수
아주대학교 물리학과

초분광 영상을 이용한 식도암 조기진단 기술 개발
:Seeing Cancer through Hyperspectral Imaging

Abstract

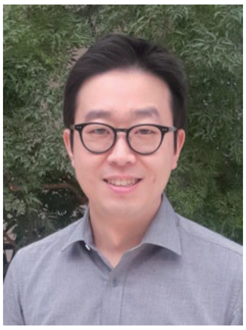
Optical imaging plays a crucial role in disease diagnosis and treatment. Light-tissue interactions allow measuring the optical properties of tissue, which enables the discrimination of healthy and abnormal tissue. Many advanced optical imaging methods have been developed and shown their potential in biomedical applications. However, only limited numbers of optical methods have been practically used in clinics due to challenges encountered during clinical translation, such as poor reproducibility or low clinician/patient acceptance. In order to overcome these challenges, I have focused on the development of the novel optical systems for practical clinical applications. In this talk, I will introduce a hyperspectral endoscopy (HySE) system for the early detection of gastrointestinal cancer. Moreover, I will show results of the pilot clinical study approved by the FDA.

Brief Biosketch

2020.03 – Present: Assistant Professor, Ajou University

2016.06 – 2020.02: Research Associate, University of Cambridge

2014.03 – 2016.05: Postdoctoral Researcher, KAIST



Taeyun Ku
Assistant Professor
KAIST

Engineering mechanical properties of human tissue specimens for large-scale molecular phenotyping

Abstract
Complex biological systems, such as the brain, can be understood properly when their fine structures, global organizations, and molecular identities are comprehensively observed. Tissue clearing technologies assisted by ultrafast microscopy have realized high-resolution imaging of intact biological tissues at a large scale. However, the capabilities of these techniques are still limited to small samples from experimental animals, particularly when macromolecular probes such as antibodies are used to label deep structures. This is because biological tissues are innately not ideal for delivering large molecules and unstable after modification to become optically transparent. I will introduce a novel tissue-engineering idea of transforming biological tissue into elastic material that is mechanically stable while enhancing the porosity. Tissues hybridized with entangled hydrogels became highly stretchable and compressible, virtually indestructible in usual laboratory settings. Such ability of transient shape transformation, which is completely reversible, was further employed to accelerate the delivery of macromolecular probes, by mechanically thinning thick samples. This simple approach reduced the time for antibody-labeling of large intact tissue specimens by up to a hundred times. The enhanced mechanical stability and labeling speed lowers the barrier to investigating large intact samples, such as human tissue specimens, at a molecular level. This tissue-engineering technology is anticipated to help uncover the high-level organizations and functions of our body.

Brief Biosketch
Taeyun Ku is an Assistant Professor in the Graduate School of Medical Science and Engineering at KAIST. He received his M.D. at Yonsei University College of Medicine and his Ph.D. in Medical Science and Engineering at KAIST. During his postdoctoral research at MIT, he developed tissue clearing and labeling techniques. His research interests focus on engineering biological tissues to visualize unrevealed structures and functions in normal and diseased organs.

Bomi Gweon
Assistant Professor
Sejong University

미세유체칩 내 세포미세환경 조절을 통한 혈관내피세포 기능장애 유발

Abstract

One of the key factors causing endothelial dysfunction are known to be the microenvironment of endothelial cells (ECs). In this study, we tried to replicate the pathophysiological function of ECs within a microchannel by mimicking the microenvironment of early atherosclerotic lesions. Given that fibronectin (FN) is deposited in early atherosclerotic plaques, we utilized FN coated hydrogels with increased stiffness for endothelial substrates within the microchannels. As a result, endothelial integrity on FN coated microchannels is shown to be undermined exhibiting a random orientation in response to the applied fluid flow, notable disruption of vascular endothelial cadherins (VE-cadherins), and higher endothelial permeability as opposed to that on microchannels coated with collagen (CL), the atheroresistant vascular model.

Brief Biosketch

Bomi Gweon is an Assistant Professor in the Department of Mechanical Engineering at Sejong University. She received her Ph.D. in Physics from KAIST (2011). From 2011 to 2014, she was a Post-doc at Molecular and Integrative Physiological Science (MIPS) Program in Harvard T.H. Chan School of Public Health, Boston, MA, USA. Then, from 2014 to 2019, she was a Research Assistant Professor in the Department of Biomedical Engineering at Hanyang University.

Jeong, Jae-Woong

Associate Professor

KAIST

Soft Wireless Optofluidic Neural Interface Technology

Abstract

Optogenetics and pharmacology are powerful techniques for dissection of complex brain circuitry with high spatiotemporal specificity. Conventional methods use optical fibers and metal cannulas for deliveries of light and drugs, respectively. However, these approaches significantly limit *in vivo* brain studies due to their tethered operation and mechanical mismatch between rigid devices and soft neural tissue, which cause increased tissue damage and inflammation response.

To tackle this significant neuroscience challenges, we have developed soft optofluidic neural implants that offer programmable wireless drug delivery and photostimulation. The devices integrate microscale inorganic light-emitting diodes and microfluidic drug delivery systems with wireless interface. This design enables compact, lightweight, soft and flexible system, thus facilitating seamless implantation and operation in the brain without causing disturbance of naturalistic behavior. This talk will introduce our recent developments in wireless optofluidic device technology for chronic *in vivo* pharmacology and optogenetics and highlight its prospects for basic neuroscience research and clinical medicine.

Brief Biosketch

Dr. Jae-Woong Jeong is an Associate Professor of Electrical Engineering at Korea Advanced Institute of Science and Technology (KAIST). He received his PhD degree in electrical engineering from Stanford University in 2012, and worked as a postdoctoral research associate at the University of Illinois at Urbana-Champaign from 2012 to 2014. Before joining KAIST, he was an Assistant Professor of Electrical, Computer & Energy Engineering at University of Colorado, Boulder from 2015 to 2017. Dr. Jeong's research focus is in the future generation bio-integrated electronics and systems for brain research and advanced healthcare. He is a senior member of IEEE and the recipient of BMES Career Development Award (2017), Samsung Global Research Outreach Award (2017), and Songam Future Scholar Research Excellence Award (2019).

Jahyun Koo
Assistant Professor
Korea University

Biodegradable neuro-electrode for next deep brain stimulation

Abstract

Biodegradable electronics provide new class of temporary medical applications which are implantable and safely disappear without any physical trace in the body system. This technology enables temporary implantable medical devices, such as temporary nerve stimulator, cardiac pacemaker and brain stimulator. Especially the biodegradable electronic systems enable temporary and safe diagnosis for the brain related disease in the future. This Presentation will give overview of biodegradable electronics for biomedical applications.

Brief Biosketch

Jahyun Koo is currently an assistant professor in the School of Biomedical Engineering at Korea University. He received his BS and MS degrees in nuclear and quantum engineering from the Korea Advanced Institute of Science and Technology (KAIST), Republic of Korea, in 2010 and 2012, respectively. He received his PhD degree in materials science and engineering from KAIST in 2017. He was a postdoctoral researcher in the Center for Bio-Integrated Electronics at Northwestern University, USA (2017-2019). He was a visiting scholar in the Materials Research Lab at University of Illinois at Urbana-Champaign, USA (2015-2016). Koo can be reached by email at jahyunkoo@korea.ac.kr.

동서연
조교수
숙명여자대학교 IT 공학과

Effect of daily mental stress on bio/brain signals

Abstract

많은 정신적 스트레스 연구는 실험적 스트레서(stressor)가 있는 상태와 없는 상태를 식별하는 데 중점을 두고 있다. 그러나 스트레스 요인이 없는 상태를 기준 상태(baseline), 즉 스트레스가 없는 상태라고 간주하기 어려울 수 있다. 현대인은 일상 생활에서 이미 많은 스트레스를 경험하고 있고, 실험 프로토콜로 일상 스트레스의 영향을 배제하기가 매우 어렵기 때문이다. 이 연구에서는 인지 능력과 생리적 반응에의 일상 스트레스의 영향을 2 주간 지속적으로 모니터링함으로써 조사하였다. 41 명의 건강한 참가자에 대해 개별 일상 스트레스 수준이 높고 낮을 때, fNIRS 기반 전두엽 피질 산소화 정도와 ECG 기반 심박 변이도를 평가했다. 결과적으로 스트레스 수준에 따라 인지 행동과 HRV 에서 상당한 차이를 발견할 수 있었습니다. 또한 fNIRS 기반의 task/rest 분류 성능은 스트레스 정도를 고려하지 않은 모델을 사용하는 것보다 높은/낮은 스트레스 수준의 훈련 샘플이 각각 있는 별도의 훈련된 모델을 사용할 때 정확도 최대 35%까지 향상되었다. 이러한 결과로부터, 실험 대상자의 일상 스트레스에 따른 인지 행동 및 생리적 반응의 변화를 이해하는 것이 중요하고, 향후 스트레스 관리를 위한 헬스케어 시스템을 설계하는 데 일상 스트레스 정도를 반영하는 것이 필요함을 알 수 있다.

Brief Biosketch

한국과학기술원 전기및전자공학과에서 학사, 석사, 박사 학위를 2010, 2011, 2016 년에 각각 받았다. 학위 과정 이후, 한국과학기술원 정보전자연구소 박사후연구원을 거쳐, 한국과학기술연구원 의공학연구소 바이오닉스 연구단에서 박사후연구원으로 2 년간 근무하였다. 2018 년 9 월부터 현재까지 숙명여자대학교 IT 공학과의 조교수로 근무하고 있고, 기계 학습 기반의 생체 신호 처리와 뇌-컴퓨터 인터페이스를 포함한 다양한 인간-컴퓨터 상호작용에 대하여 연구하고 있다.

Jaesok Yu
Assistant Professor
Department of Robotics Engineering, DGIST,
Daegu, South Korea

Super-resolution ultrasound imaging: Beyond the acoustic diffraction limit

Abstract

Traditional ultrasound imaging techniques are limited in spatial resolution to visualize angiogenic vasa vasorum that is considered as an important marker for atherosclerotic plaque progression and vulnerability. The recently introduced super-resolution imaging technique based on microbubble center localization has shown potential to achieve unprecedented high spatial resolution beyond the acoustic diffraction limit. However, a major drawback of the current super-resolution imaging approach is low temporal resolution because it requires a large number of imaging frames. In this talk, a new imaging sequence and signal processing approach for super-resolution ultrasound imaging are presented to improve temporal resolution by employing deconvolution and spatio-temporal-interframe-correlation based data acquisition and motion compensation. The proposed method not only identifies a tiny vessel with a diameter of 41 μm, 5 times higher spatial resolution than the acoustic diffraction limit at 7.7 MHz, but also significantly improves temporal resolution that allows for imaging vessels over cardiac motion.

Brief Biosketch

- 2019 ~ Present: Assistant Professor, Department of Robotics Engineering, DGIST, Daegu, South Korea
- 2018 ~ 2019: Post-doctoral Fellow, Department of Electrical and Computer Engineering & Department of Biomedical Engineering, Georgia Institute of Technology, Atlanta, GA, USA
- 2013 ~ 2018: Ph.D., Department of Bioengineering, University of Pittsburgh & University of Pittsburgh Medical Center, Pittsburgh, PA, USA
- 2009 ~ 2011: M.S, Department of Electronic Engineering, Sogang University, Seoul, South Korea
- 2002 ~ 2009: B.S, Department of Electronic Engineering, Sogang University, Seoul, South Korea

Ju Hun Lee

Assistant Professor

Department of Bionanotechnology, Hanyang University

Biomimetic Filamentous Phage based System Design

Abstract

Design of new materials with well-defined structures and desirable functions is a challenge in materials science, particularly when these materials have nanometer-scale dimensions. In nature, however, complex functional nanostructures are created through the self-assembly of physically and chemically simple basic building blocks. In appropriate conditions, nanofibers can achieve momentarily favored far from equilibrium states that stabilize the nano/micro-scale self-assembled structures that combine into macroscopically organized hierarchical structures. Recently, by mimicking self-assembly processes in nature, various functional nanomaterials have been developed using self-assembly of genetically and chemically engineered viral particles.

I firstly introduce chemically engineered M13 bacteriophage for templated assembly of nanoparticles in protein sensing applications. As an advanced approach for highly sensitive, reliable, simple, quantitative analysis of multiple markers in solution, we developed a nano-bio transducer based on chemically functionalizable M13 bacteriophage bio-recognition receptors as a template. Next, I focus on exploiting the helical nanofiber shape of M13 bacteriophage (phage) and its self-assembled liquid crystalline structures for designing helical-nanofiber-based diverse structures. As an example, we developed a novel sensitive and selective color sensor that utilizes cross-reactive M13 phage structural array matrices and an accompanying smartphone-based sensing system. Lastly, I demonstrate vertically aligned and polarized piezoelectric nanostructures from biological piezoelectric nanofibers, M13 phage, with control over the orientation, polarization direction, microstructure morphology, and density using genetic engineering and template-assisted self-assembly process. The resulting vertically ordered structures exhibit strong unidirectional polarization. The resulting vertically self-assembled phage structure can be used as a piezoelectric energy harvester (PEH).

Brief Biosketch

Dr Ju Hun Lee earned his B.S. and M.S. degrees in Materials and Science Engineering (MSE) from Korea University and his Ph.D. degree in MSE from UC, San Diego. He worked as a postdoctoral fellow at UC Berkeley/Lawrence Berkeley National Lab. Currently, He is an assistant professor at Hanyang University, ERICA Campus. His current research focuses on the design of biomimetic nano + biomaterial integrated system.

Jung, Dong-Keun
Professor
Dept. of Medical Engineering, College of Medicine,
Dong-A University

Basic Medical Science and Medical Engineering

Abstract

For students of biomedical engineering who are preparing for the national qualifications for medical technician and industrial technician, I would like to cover the core contents of the 'Basic Medical Science and Medical Engineering' subjects. It deals with the structure and function of the human body required in the field of medical engineering, and mainly describes electrophysiology and bioelectric phenomena.

Brief Biosketch

Dong-Keun Jung graduated Pusan National University College of Medicine in 1989 and earned Ph.D. in Physiology from the same university. The teaching profession was received by a full-time instructor at the Dong-A University College of Medicine Department of Physiology in 1997, and since 2002 a new Department of Medical Engineering has been established for education and research activities. The main research field is biosignal measurement.

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의용전자공학

- “의료기기의 전기·기계적 안전에 관한 공통기준규격" 중심으로 -

Abstract

의용전자공학은 의공학 교육분야의 core 교과목이며 국가기술자격인 의공기사 및 의공산업기사의 검정교과목 중의 하나이다. 본 세션에서는 의료기기 인허가과정의 필수 규격인 IEC-60601-1 의료기기의 전기·기계적 안전에 관한 공통기준규격 및 식품의약품안전처 고시에서 제시하고 있는 접지누설전류, 접촉전류, 환자누설전류, 환자측정전류의 기준시험방법에 대하여 소개하고 대학의 의용전자공학 관련 실험실습 교육의 보완 및 개선 방향에 대하여 논의한다.

Brief Biosketch

Yonghyeon Yun received the B.S. degree in electronic engineering from the Seoul National University of Science and Technology, Seoul, Korea, in 1998, and the M.S. and Ph.D. degrees in biomedical engineering from Yonsei University, Seoul, in 2002 and 2011, respectively. He was a Research Scientist with the Korea Research Institute of Standards and Science, Deajeon, Korea, from 1999 to 2011. He was a Post-Doctoral Research Fellow with the Division of Cardiology, Severance Hospital, Yonsei University Health System, Seoul, from 2011 to 2013. Since 2013, he has been with the faculty of the Daelim University College, as an Assistant Professor of Convergence Biomedical Engineering. His current interests include medical ultrasound, biomedical signal processing and instrumentation, and u-healthcare applications.

Eun Bo Shim

PhD

Kangwon National University

의용기계공학-생체유체역학 응용

Abstract

본 강연에서는 의용기계공학을 소개한다. 그리고 의용기계공학의 한 중요한 분야인 생체유체역학의 기본적 내용과 접근방법 등을 설명하고, 이에 대한 응용사례를 소개한다. 특히 최근에 주목받고 있는 환자맞춤형 혈류시뮬레이션에 대해 그 의의와 중요성을 논의한다.

Brief Biosketch

Dr. Shim is the Professor of Kangwon National University and the CEO of AImedic Inc (Seoul). He finished undergraduate course at the Mechanical Engineering of Seoul National University and then received two PhDs; PhD degree in Mechanical Engineering from the KAIST in 1994 and PhD degree in medicine from Kyoto University (Japan) in 2008. He has been the Professor of Kangwon National University in Chuncheon from 2003 and was the director of the National Research Laboratory (NRL) from 2008 to 2013. He founded AImedic Inc in 2014. His major research interest is the computer simulation of cardiovascular hemodynamics.

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의료기기

Abstract

의료기기법에 따른 의료기기 정의가 소프트웨어 기술 등 최신 의료기기 품목 동향에 어떻게 적용되는지 알아본다. 체외진단의료기기와 의료기기산업법 등 변화된 의료기기 관련 법규를 소개한다. 진단 및 치료기기의 기본 구성과 인허가 절차에서 요구되는 필수 안전성 및 성능평가의 이해를 통해 의료기기의 사용목적와 원리에 있어서 주요하게 학습해야 할 점을 파악한다.

Brief Biosketch

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