

연구분야 소개

연세대학교 기계공학부

YONSEI,
Leading the Way to the Future

Computational Mechanics of Materials Laboratory

전산재료역학 실험실 https://sites.google.com/site/kwkanglab/



강 건 욱

(Keonwook Kang, Ph. D)

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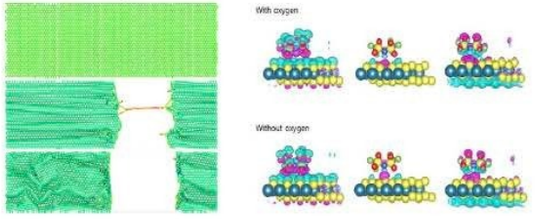
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Research Area

- ❑ **Mechanical/Electrical Properties in Nano-scale**
- ❑ **Material Behaviors in Extreme Environment**
- ❑ **Multi-scale Modeling of Crystal Plasticity**
- ❑ **Structural Analysis and Optimization**

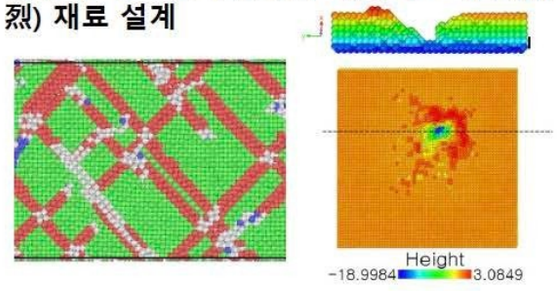
나노 재료 기계적/전기적 특성

나노 재료의 기계적/전기적 물성과 변형 기작을 원자전산모사기법 (분자 동역학 및 제1원리 계산)을 활용하여 분석



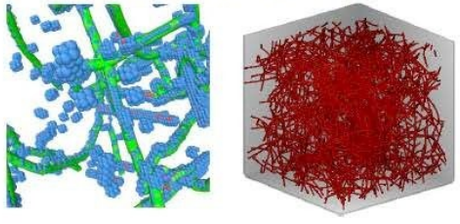
극한 환경에서의 재료 거동

고온/충격/조사/우주 환경과 같은 열악한 상황에서 재료 열화 현상을 이해하고 내열(耐烈) 재료 설계



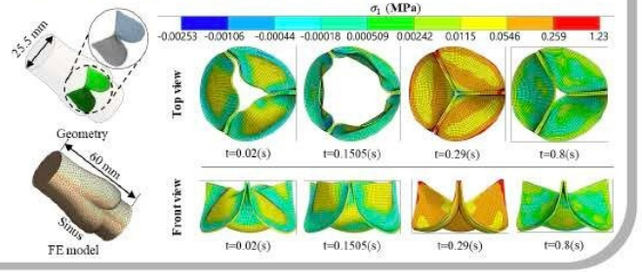
다중스케일 결정소성

나노에서 매크로까지 다양한 스케일을 아우르는 계층적 다중스케일 전산모사기법을 활용하여 결정재료 소성거동 연구



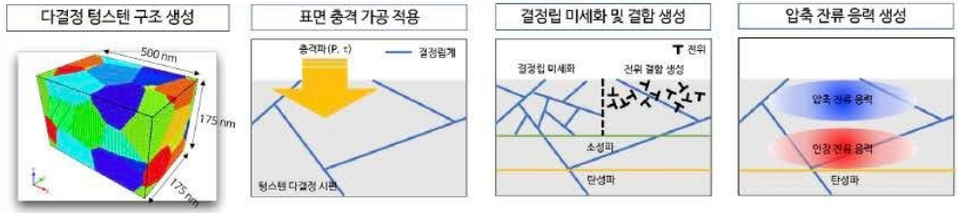
구조해석 및 최적화

연속체 기반 전산기법(FEM 등)을 활용한 구조해석 및 최적화 연구 수행



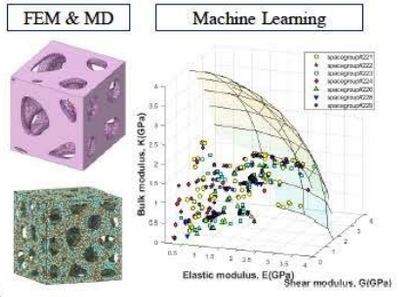
Selected On-going Projects

- **표면 충격 가공을 활용한 핵융합 대면재 성능 향상 연구**
  (한국연구재단 중견연구사업)

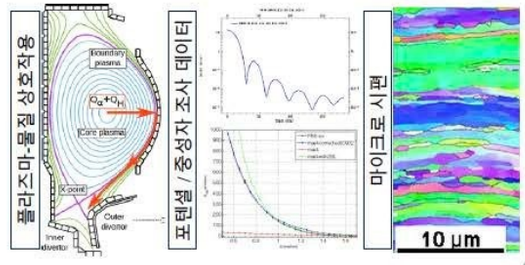


분자동역학 기반 텅스텐 대면재 물성 개선방법 모식도

- **기공구조의 물성 개선 연구**
  (에어로겔소재연구센터/ERC)

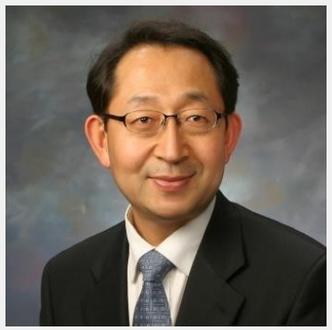


- **핵융합로 플라즈마 대면재 성능 평가 전산모사 테스트베드 개발 연구**
  (한국수력원자원 K-Cloud 사업)



Nanofabrication & Microoptics Laboratory
마이크로 나노 응용 기술 개발
http://nanofab.yonsei.ac.kr

Yonsei University
School of Mechanical Engineering



강 신 일

(Shinill Kang, Ph. D)

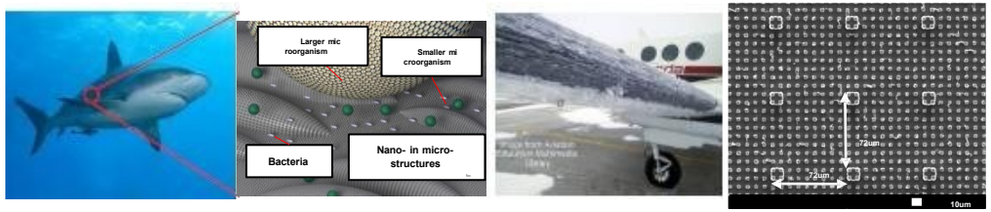
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Research Area

- ❑ Nanotechnologies for automobile, vessel and aerospace applications
- ❑ Nano fabrication / Device design
- ❑ Nano biosensor device
- ❑ Microoptics / Nanophotonics

Nanotechnologies for automobile, vessel and aerospace

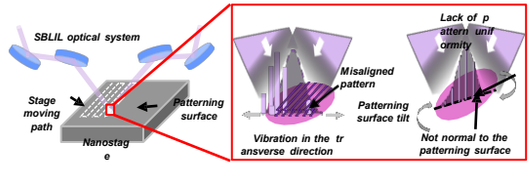
- Functional surface for drag reduction and anti-icing



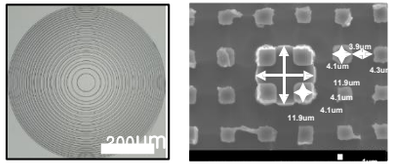
[Functional surface for drag reduction] [Functional surface for anti-icing]

Nanofabrication / Device design

- Development of laser scanning interference lithography system
- Glass/Metal pattern fabrication using rapid surface heating



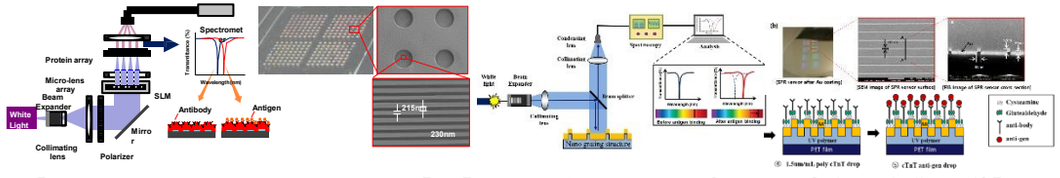
[Laser scanning interference lithography]



[Micro-Nano fabrication]

Nano bio sensor device (Biomedical)

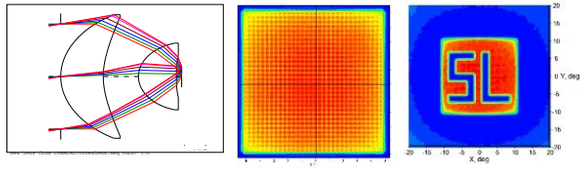
- Multi Optical Probe protein sensor for parallel detection system
- Normal incident surface plasmon resonance protein sensor as POCT



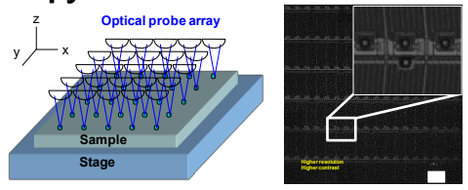
[GMR protein microarray system] [SPR protein sensor for cTnT(심근경색표지)]

Microoptics / Nanophotonics

- Pixel light design
- Multi-optical probe Confocal microscopy



[Pixel light design]



[Multi-optical probe Confocal microscopy]

Optics Quantum Lab
광학 양자 연구실

https://sites.google.com/yonsei.ac.kr/oql/

Yonsei University
School of Mechanical Engineering



김 경 식
(Kyoungsik Kim, Ph. D)

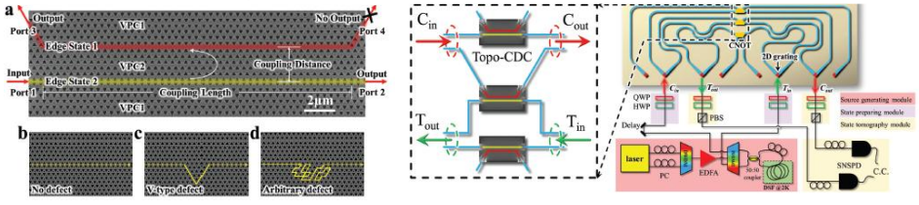
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Research Area

- ❑ 메타물질 기반 양자로직 게이트
- ❑ 위상 양자오류정정 기술(QEC)
- ❑ 포토닉 상온 양자컴퓨팅 기술
- ❑ 저전력 포토닉 뉴로모픽 컴퓨팅
- ❑ Optical/Quantum 신경망 기술
- ❑ 위상광학 포토닉스

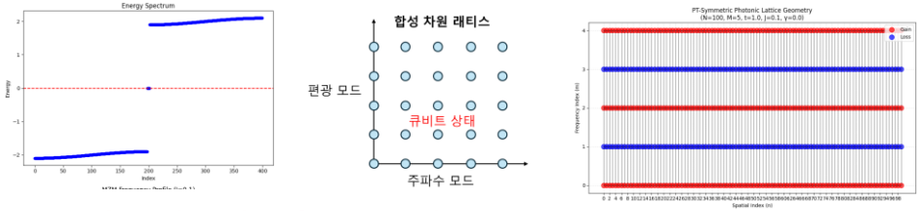
Quantum logic gates with metamaterials

- CNOT gate, Hadamard gate
- Metasurface, metamaterials



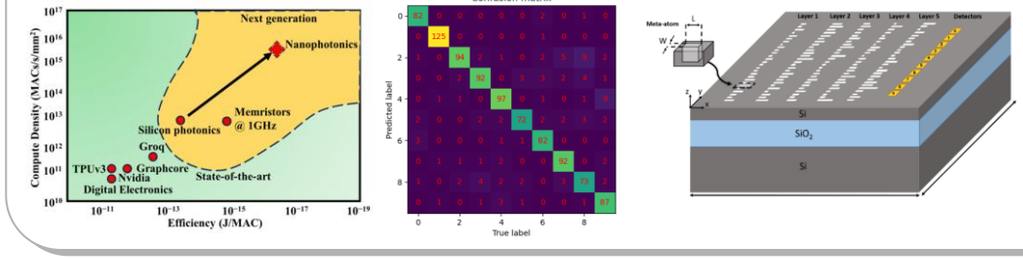
Quantum error correction/포토닉 상온 양자컴퓨팅

- Majorana zero modes를 이용한 고성능 양자 연산
- Topological Quantum Error Correction



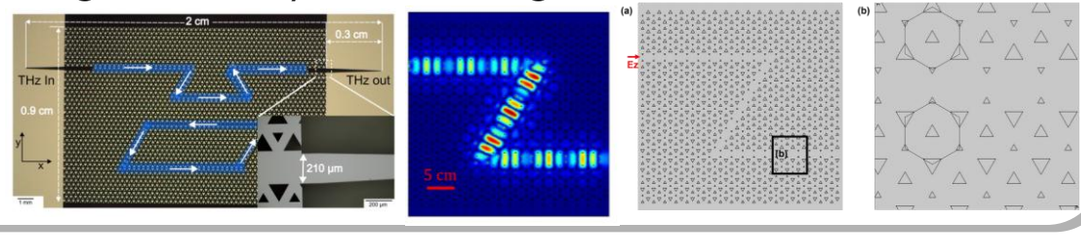
저전력 Photonic Neuromorphic Computing

- Optical Neural Networks, Quantum Neural Networks



Topological photonics

- Photonic spin Hall effects, Topological waveguides
- High-sensitivity sensors & light sources

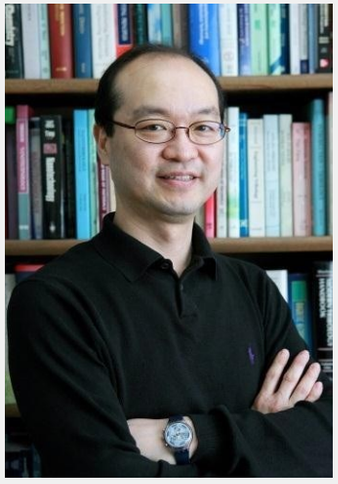


Center for Nano-Wear

CNW

http://cnw.yonsei.ac.kr

Yonsei University
School of Mechanical Engineering



김 대 은

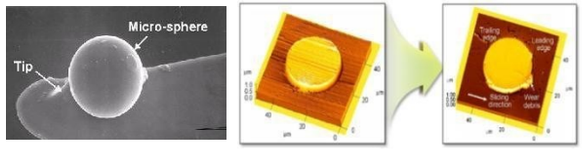
(Dae-Eun Kim, Ph. D)

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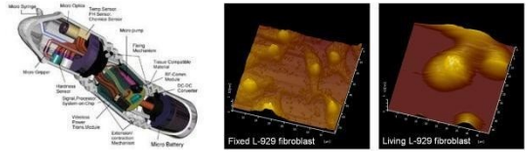
Research Area

- ❑ 마찰/마모 저감기술 개발
- ❑ CNT/graphene 응용 기술
- ❑ 기능성 표면 설계 및 제작
- ❑ 마찰/마모 현상 simulation
- ❑ 초정밀 부품의 신뢰성 및 내구성

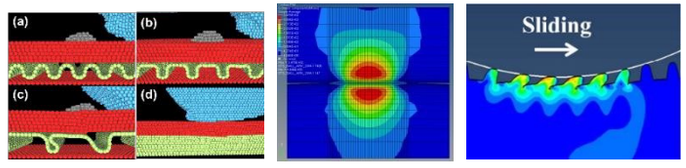
❑ **Micro/nano-scale friction and wear control of precision systems**



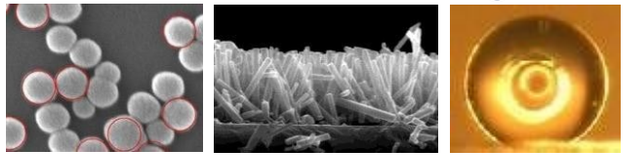
❑ **Tribology of medical devices and biological tissues**



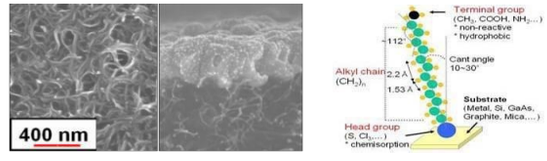
❑ **FEM and atomic-scale simulation of interface mechanics**



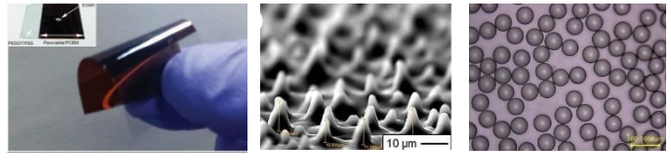
❑ **Precision micro-machining and functional surface coatings**

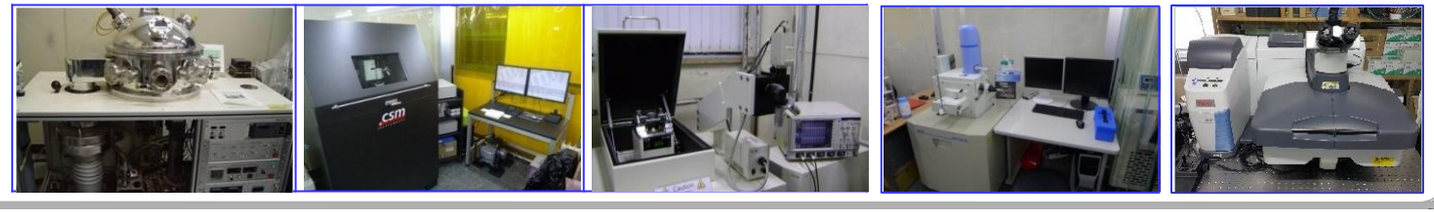


❑ **Energy efficient surface technology and conservation of resources**



❑ **Flexible device/polymer-based surface design for low wear**





CNW CENTER FOR NANO-WEAR

NRF National Research Foundation of Korea

Creative Research Initiative 창의적 연구 진흥 사업단

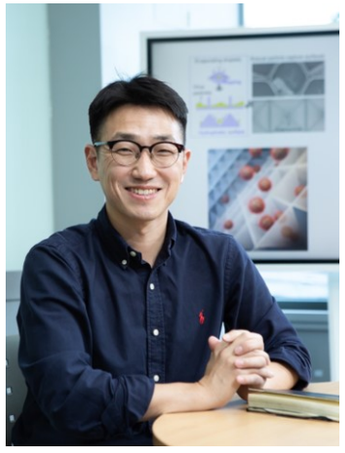
MAX: Multiscale Architecture and eXtreme manufacturing

멀티스케일 구조설계 및 극한제조 연구실

https://sites.google.com/view/seoklab

Yonsei University

School of Mechanical Engineering



김 석

(Seok Kim, Ph. D)

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Research Area

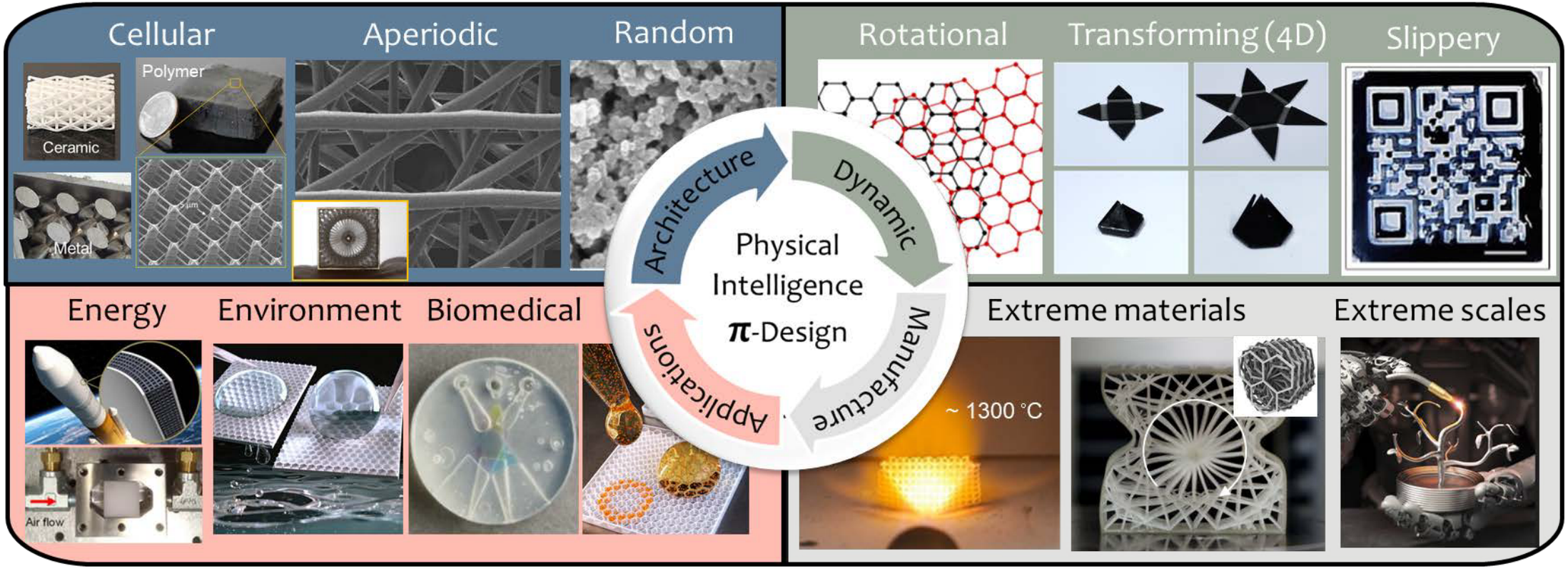
(1) Physical Intelligence (***π***) Design [물리지능 활용 설계]

(2) Multiscale Cellular Architectures [멀티스케일 다공구조]

(3) Dynamic & Smart Materials [스마트 프로그래머블 소재]

(4) Extreme Manufacturing [극한 및 첨단 제조 시스템 개발]

(5) 3D/4D Printing & *Beyond* [3D/4D 프린팅 & 기계메타물질]



Nano-Optoelectronics System Lab
나노광전자시스템 연구실
http://nos.yonsei.ac.kr

Yonsei University
School of Mechanical Engineering



김 영 주
(Young-Joo Kim, Ph. D)

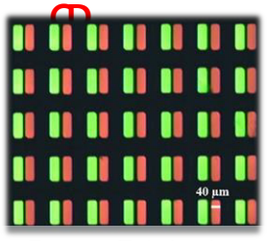
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Research Areas

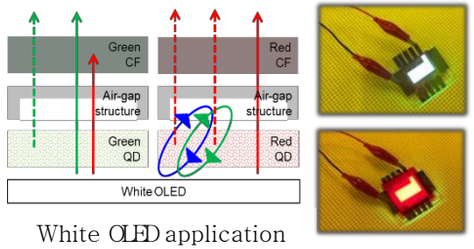
- ❑ Design of Quantum Dot for Display
- ❑ Design of Organic Light Emitting Diode
- ❑ Laser Display Applications
- ❑ Design/Fabrication of Optical Components
- ❑ Optical/Thermal Analysis of Display

Design of Quantum Dot for Display

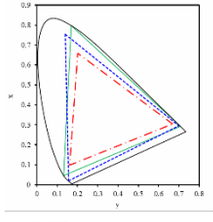
➢ Patterned quantum dot converted white OLED&LCD



Pattern Fabrication

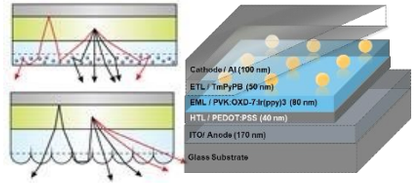


White OLED application

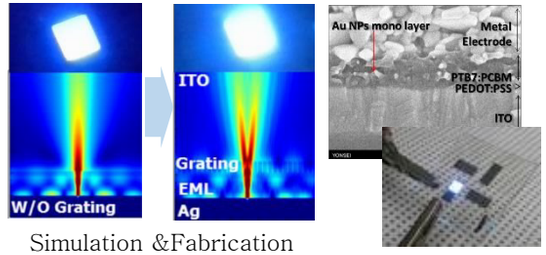

LCD application

Design of Organic Light Emitting Diode

➢ High extraction efficiency OLED reducing Optical Loss



Optical Loss Analysis & Device Design

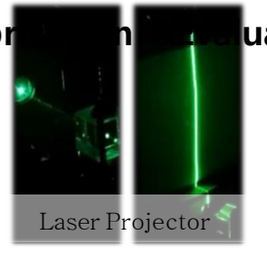


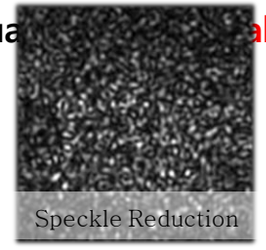
Simulation &Fabrication

Optical Components for Various Applications

➢ Design, Fabrication and Evaluation of Optical Components


Head-Up Display

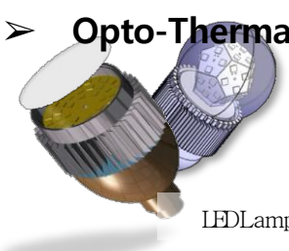

Laser Projector

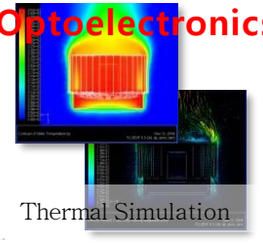

Speckle Reduction

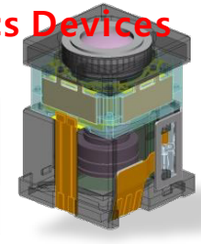

Laser Head Lamp

Optical &Thermal Analysis for Optoelectronics

➢ Opto-Thermal Simulation for Optoelectronics Devices


LED Lamp Design


Thermal Simulation



Microsystem Lab

마이크로시스템 연구실

http://mems.yonsei.ac.kr

Yonsei University

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김 용 준

(Yong-Jun Kim, Ph. D)

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Research Area

MEMS based

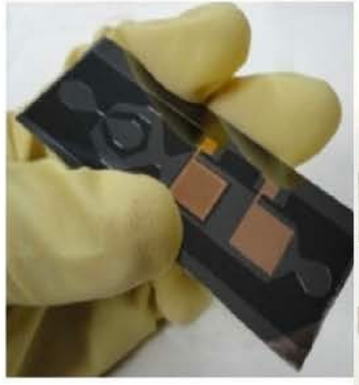
- ❑ Environmental monitoring
- ❑ Microfluidics & Biomedical application

Artificial Intelligence based

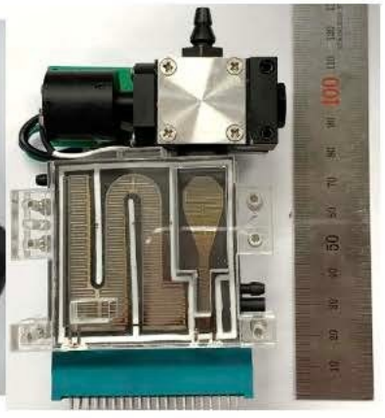
- ❑ Sensor fusion

Environmental monitoring

❑ **MEMS** 기술을 이용한 대기 중 나노/마이크로 크기 미세입자의 분류, 감지 소자 개발 기술



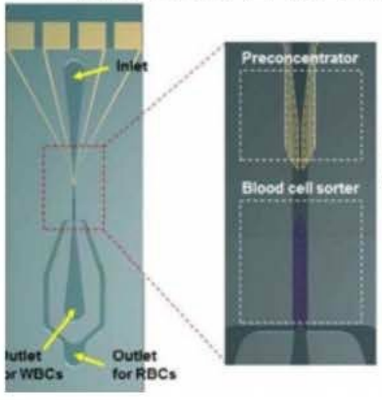
[Virtual impactor]



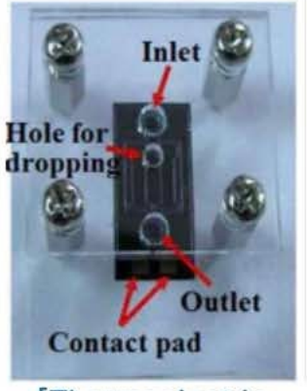
[Nano-particle counter]

Microfluidics & Biomedical application

❑ 미세유체채널 기반의 세포 분류 기술 및 유해 미생물 감지 기술



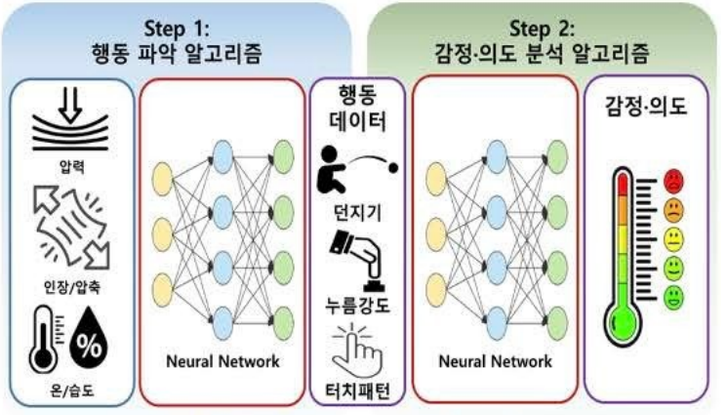
[Cell sorter]



[Thermoelectric biosensor]

AI based sensor fusion

❑ 인공지능 기반 알고리즘과 다종 센서 데이터를 이용하여 고차원적 결과 도출



[Multi-data analysis and interpretation algorithm]

ATEL Advanced ThermoEngineering Lab

어드밴스드 열공학연구실 http://atel.yonsei.ac.kr

Yonsei University
School of Mechanical Engineering



김 우 철 교수

(Woochul Kim, Ph. D)

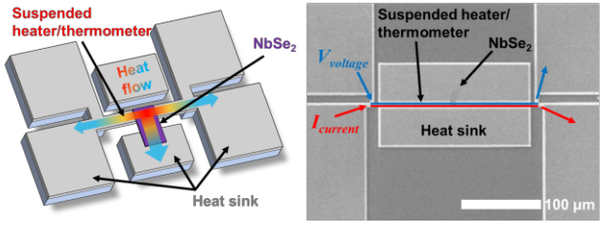
OFFICE : 제 3공학관 C428호
TEL : (02) 2123-5816
Email : woochul@yonsei.ac.kr

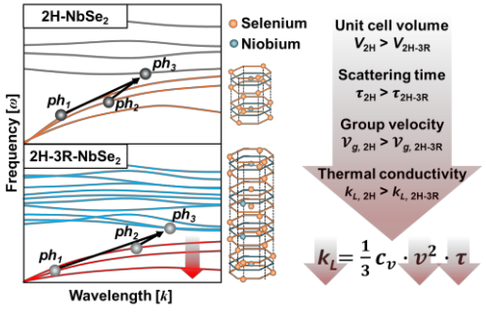
Research Area

- ❑ Thermal Energy Transport
- ❑ Body Heat Harvesting
- ❑ Thermal Management
- ❑

Multi-scale Heat Transfer

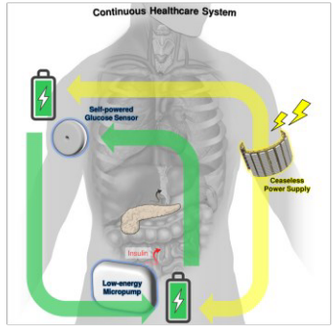
Thermal energy transport

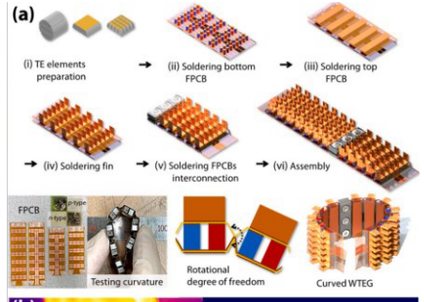


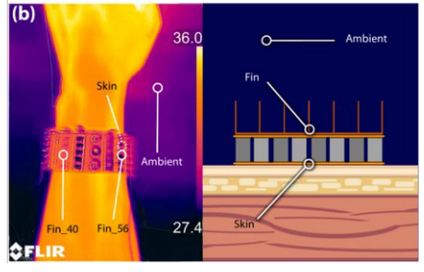


Body Heat Harvesting

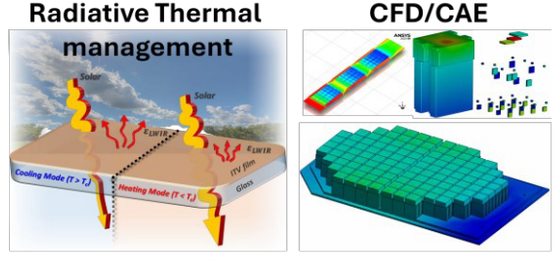




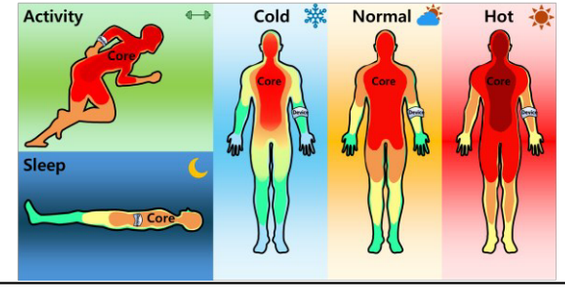




Thermal management



Personal Thermal Management



Small-scale Fluids Lab.
미소유체연구실

(Webpage is under construction)

Yonsei University
School of Mechanical Engineering



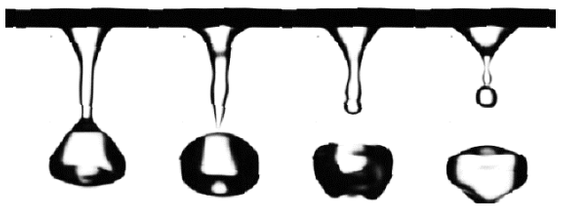
김 원 정
(Wonjung Kim, Ph. D)

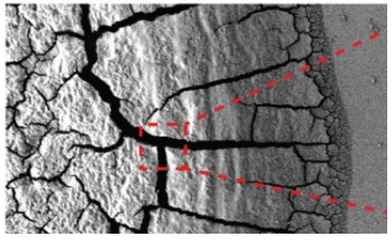
OFFICE : 제 1공학관 A586호
TEL : (02) 2123-4471
Email : wjk@yonsei.ac.kr

Research Area

- ❑ 미소 유체 물리학 실험 및 이론
- ❑ 첨단 액체 재료 생산 기술
- ❑ 다공성 소재 수분 제어 기술
- ❑ 혁신 의료 기술 개발

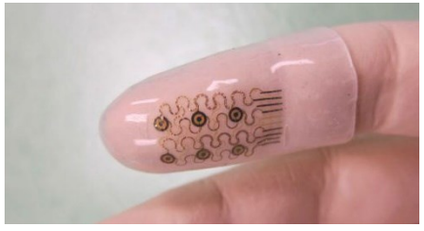
미소 유체 물리학 실험 및 이론
- 액적, 기포, 액막 거동에 관한 실험적, 이론적 연구



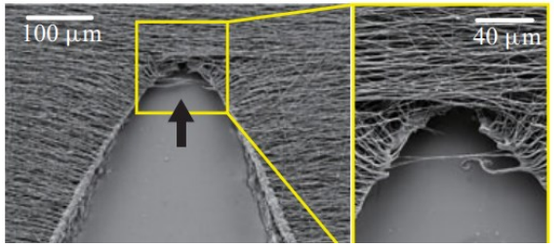


첨단 액체 재료 생산 기술
- 갈륨 기반 액체 금속 이용 유연 전극 제조 기술



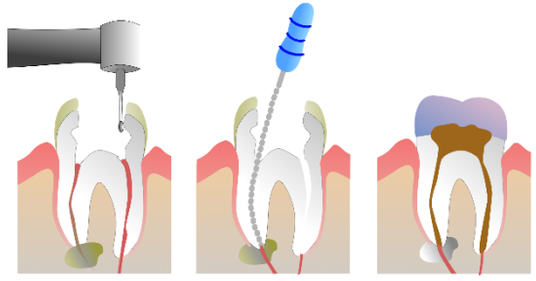


다공성 소재 수분 제어 기술
- 섬유, 전자, 제약 재료 흡수 및 건조 제어 기술 개발





혁신 의료 기술 개발
- 미세 기포 이용 자동 치아 신경 치료기기 개발





Nano Transducers Laboratory
나노 기전시스템 연구실
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Research Area

- ❑ AI 기반 나노 소재 공정 최적화
- ❑ 초미세 전자기계시스템 (NEMS/MEMS)
- ❑ 인간-기계 인터페이스 (HMI)
- ❑ 웨어러블 유연/신축성 소자
- ❑ 메디컬 디바이스 (Medical device)

AI 기반 생산 공정 최적화

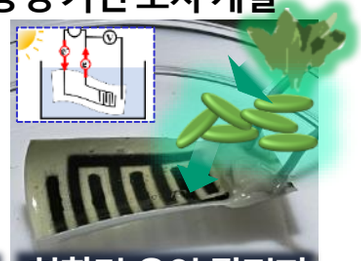
-정밀 제어된 나노 소재 공정 기반 고기능성 기전 소자 개발



AI 기반 프린팅 최적화

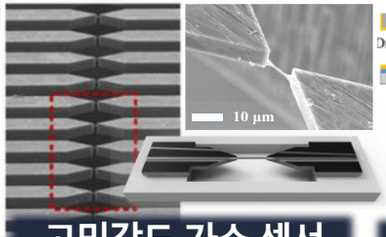


대면적 열음향 스피커

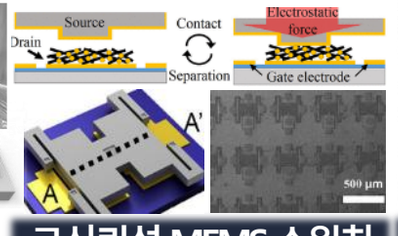

친환경 유연 광전지

초미세 전자기계시스템 (NEMS/MEMS)

- 마이크로 기전 시스템 기반 센서 & 액추에이터 개발



고민감도 가스 센서



고신뢰성 MEMS 스위치



2-DoF 마이크로미러

웨어러블 유연/신축성 소자

-유연성/신축성을 가지는 착용 가능한 전자 소자



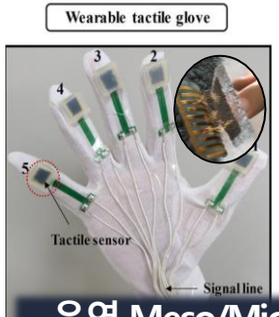
Stretchable 촉각 센서



잉크젯 기반 패브릭 소자

인간-기계 햅틱 인터페이스

-가상 촉감 구현을 위한 센서/액추에이터 개발





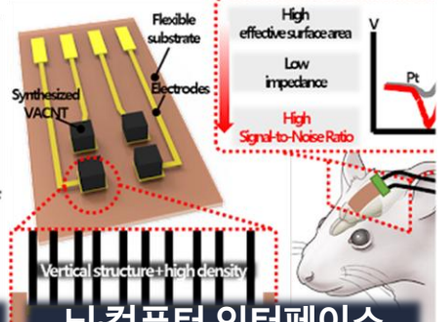
유연 Meso/Micro 촉각 인터페이스

메디컬 디바이스

-스마트 인공 방광/뇌·컴퓨터 인터페이스 개발



IoT 인공 방광



뇌·컴퓨터 인터페이스

LiDM Laboratory for Intelligent Devices and Manufacturing

지능소자공정 연구실 http://yslidm.com

Yonsei University
School of Mechanical Engineering



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Research Area

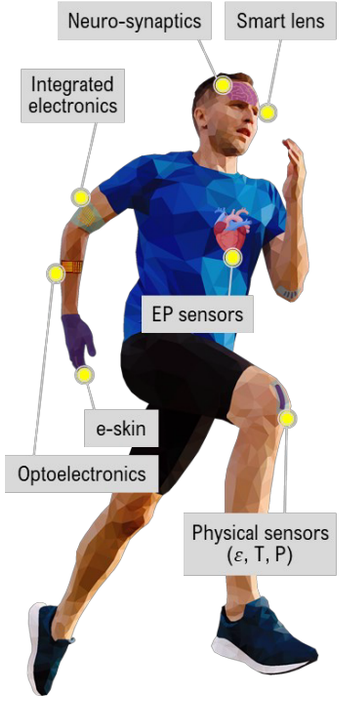
Mechanically stretchable and flexible electronics

Intelligent/neuromorphic electronic skin

Soft electronics for Human-Machine Interfaces

Mechanical properties of the materials
at micro/nano scales (Experimental, Numerical)

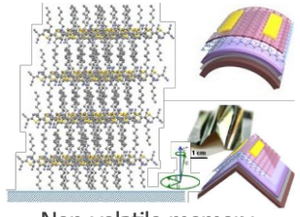
Soft-electronics



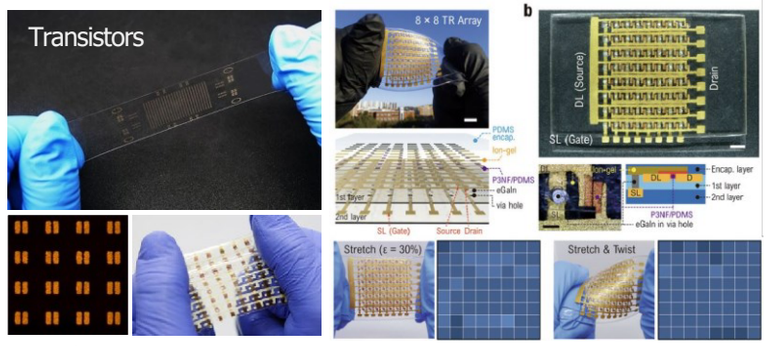
유연 전자소자 및 센서

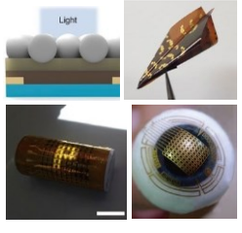
- Electronic components, Bio-sensors, Soft-robots, e-skins, Power devices

Soft electronics through manufacturing innovation

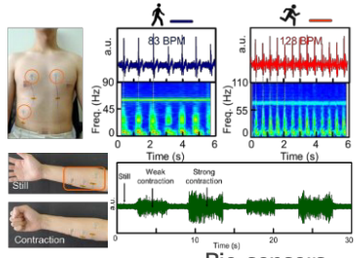


Non-volatile memory

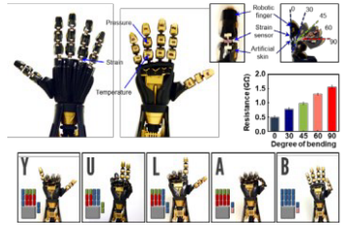




Opto-electronics



Bio-sensors



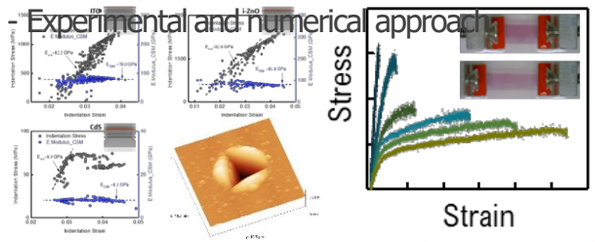
Electronics skin for HMIs

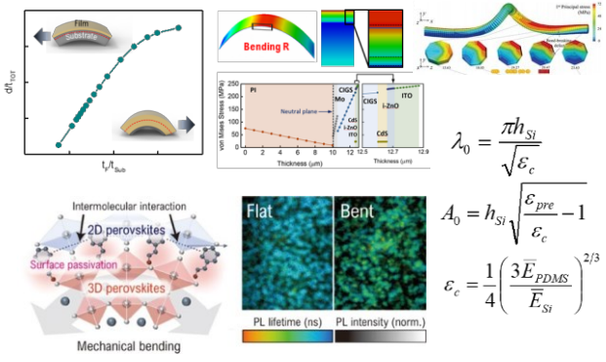


Soft robots

기계적 물성 및 메커니즘 분석

- Experimental and numerical approach





$$\lambda_0 = \frac{\pi h_{Si}}{\sqrt{\varepsilon_c}}$$

$$A_0 = h_{Si}\sqrt{\frac{\varepsilon_{pre}}{\varepsilon_c} - 1}$$

$$\varepsilon_c = \frac{1}{4}\left(\frac{3\bar{E}_{PDMS}}{\bar{E}_{Si}}\right)^{2/3}$$

BioMedical & Energy System Lab.

바이오메디컬 & 에너지 시스템 연구실

http://lab.bmesyonsei.com

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류 원 형

(WonHyoung Ryu, Ph. D)

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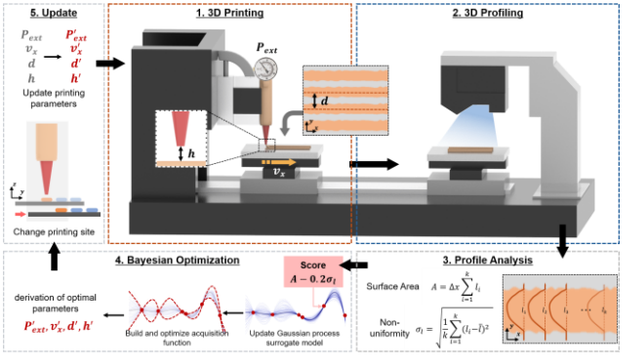
E-mail : whryu@yonsei.ac.kr

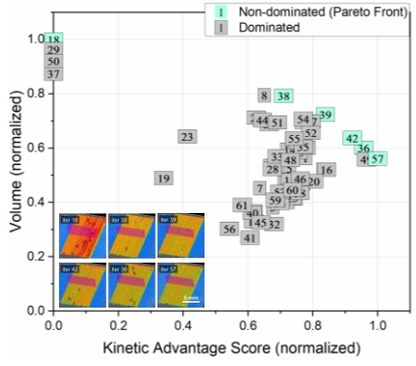
<Research Area>

- AI-assisted 3D Printing
- Energy Harvesting & Storage
- Bio-sensors
- Drug Delivery Systems

<AI-assisted Functional 3D Printing>

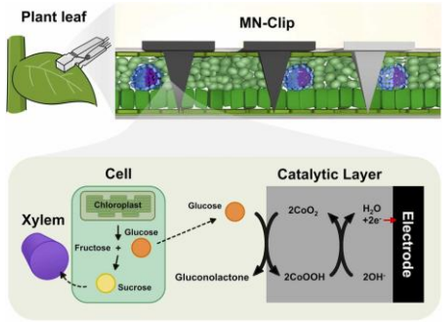
- Fully autonomous optimization, AI-driven assessment

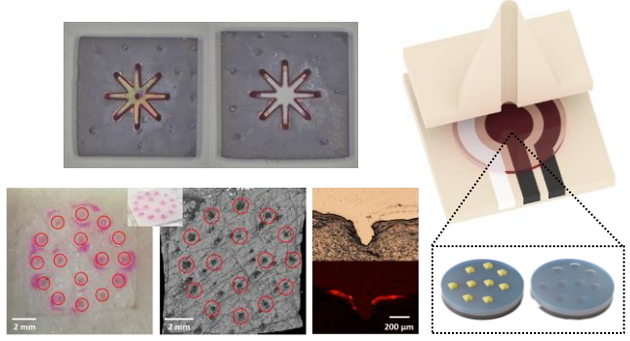




<Bio-sensors>

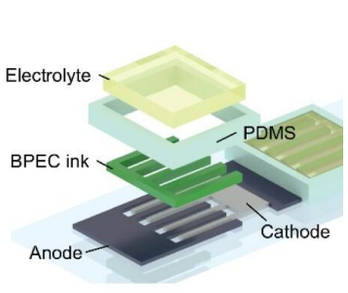
- Implantable & wearable sensors, Precise detection sensors

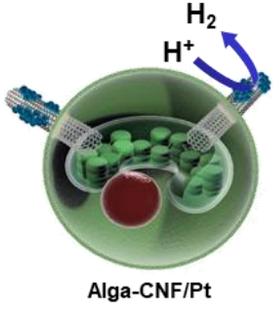


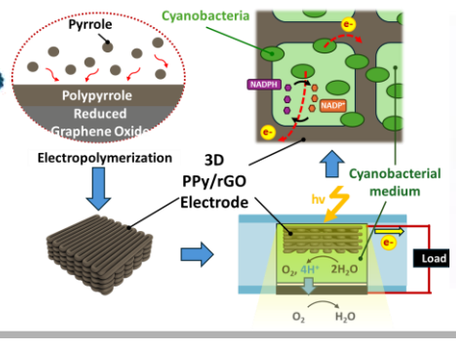


<Energy Harvesting & Storage>

- Photosynthetic Bio-Solar Cells, Supercapacitors, Hydrogen

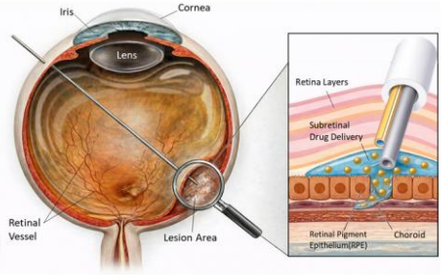


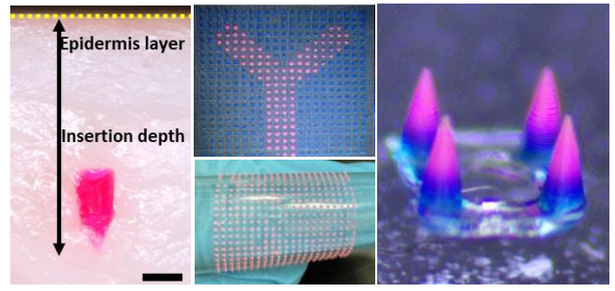




< Drug Delivery Systems>

- Target drug delivery, Multi-drug microneedle drug delivery





CS-AI Lab

계산과학-인공지능 연구실

http://csailabyonsei.quv.kr

Yonsei University
School of Mechanical Engineering



민경민

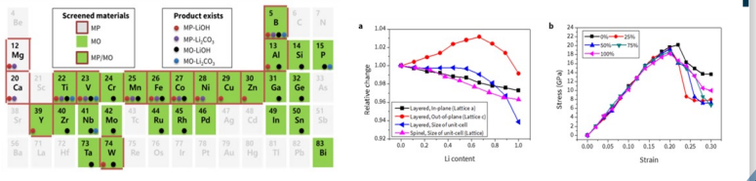
(Kyoungmin Min, Ph. D)

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TEL : (02) 2123-4464
Email : kmin.min@yonsei.ac.kr

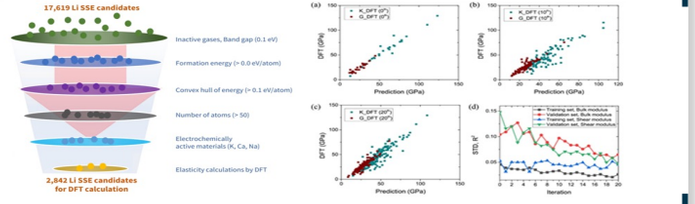
Research Area

- ❑ 계산과학 기반 신소재 탐색/설계
- ❑ AI 기반 최적 설계 방법론 개발
- ❑ 대용량 계산 기반 Big data 분석
- ❑ 계산과학 시뮬레이션 기법 개발

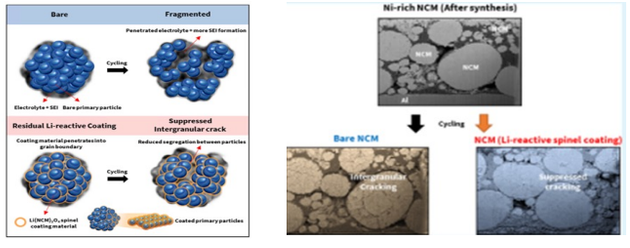
계산과학(DFT, MD) + 인공지능 융합



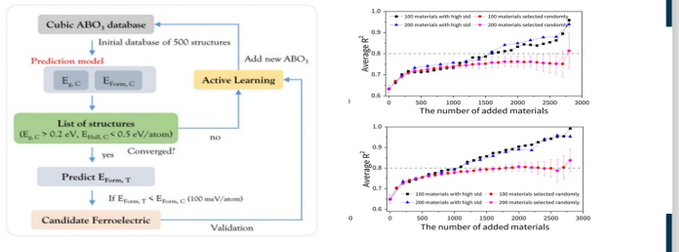
머신러닝/딥러닝 기반 신소재 탐색/설계



연구 핵심기술 도메인



응용분야: 배터리, 반도체, 디스플레이



최적 설계 방법론

Manufacturing & Mechatronics Lab.

생산 & 메카트로닉스 연구실

minlab.yonsei.ac.kr

Yonsei University
School of Mechanical Engineering



민병권

Tel: (02) 2123-5813

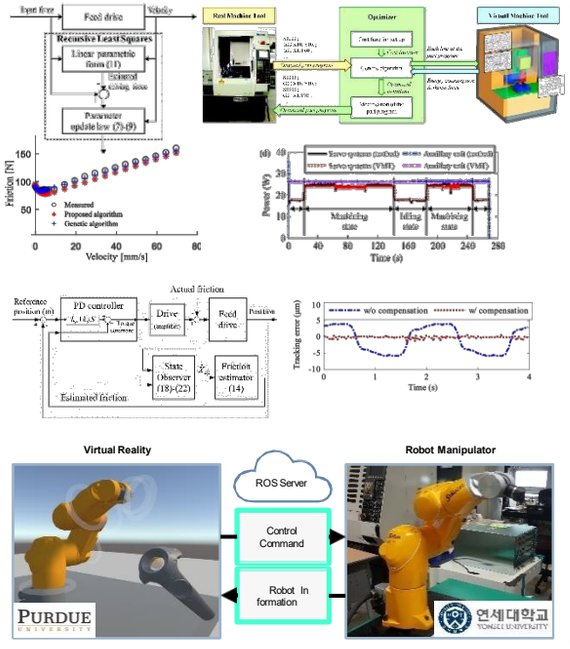
Office: 1공학관 N203호

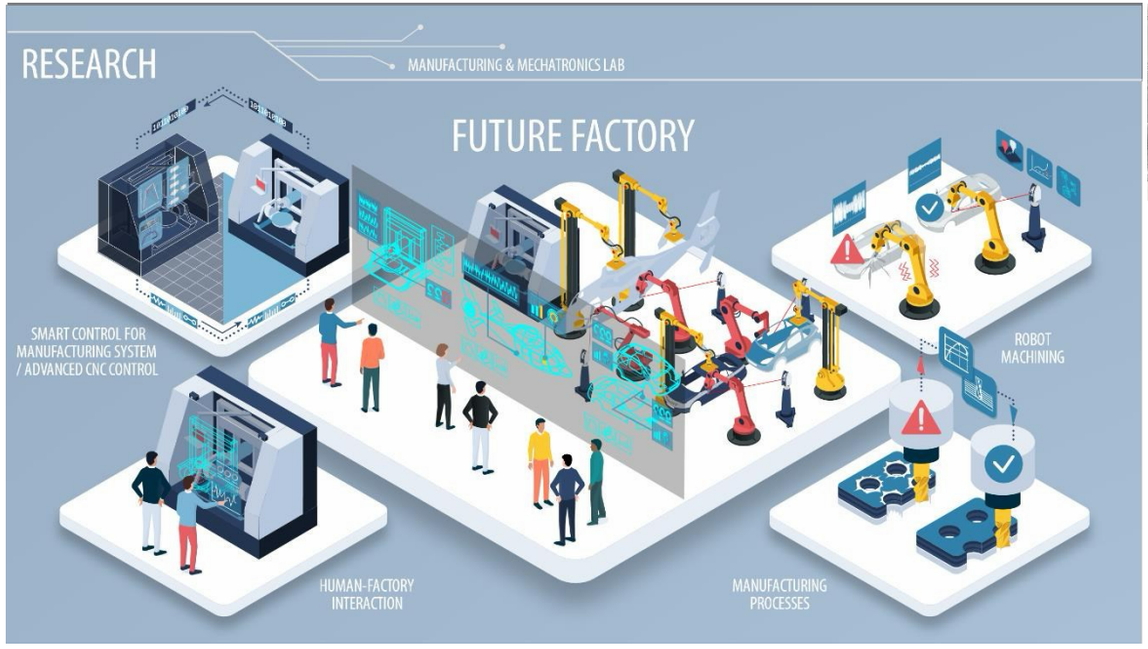
E-mail: bkmin@yonsei.ac.kr

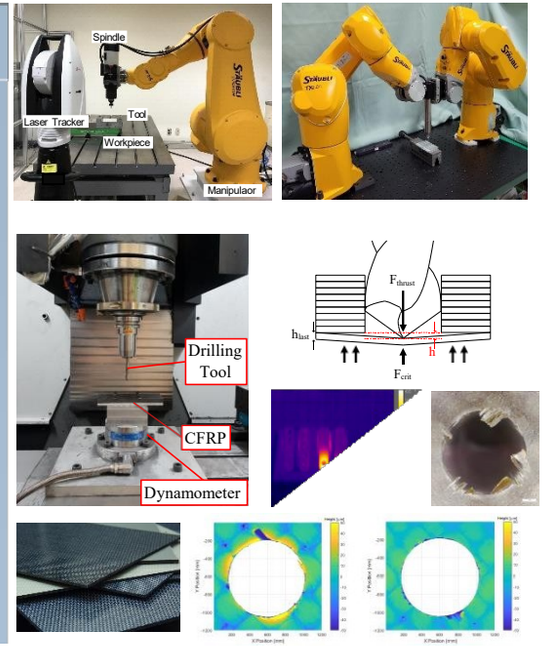
Research Area

- 지능형 생산시스템 및 차세대 공작기계 제어기
- 로봇을 이용한 가공시스템
- 탄소섬유복합제 및 첨단소재 가공

현재 수행중인 연구분야 및 사례







- Digital twin 구현을 위한 공작기계의 고속시뮬레이션 및 가공정밀도 / 소비에너지 최적화 기술
- 차세대 공작기계를 위한 스마트 CNC 원천기술 연구
- 가상현실 및 Digital twin 활용한 원격지 협동 로봇의 제어
- 실시간 레이저 측정을 이용한 가공 로봇의 피드백 제어
- 다중 로봇을 이용한 가공정밀도 향상 기술
- 탄소섬유복합재의 가공공정 최적화: 박리현상 억제를 위한 공정설계, 실시간 공정제어 등

VIBOM

진동 및 광메카트로닉스 연구실

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Yonsei University

School of Mechanical Engineering



박노철

(No-Cheol Park, Professor)

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TEL : (02) 2123-4530

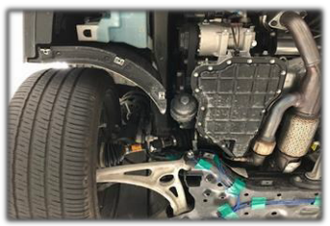
Email : pnch@yonsei.ac.kr

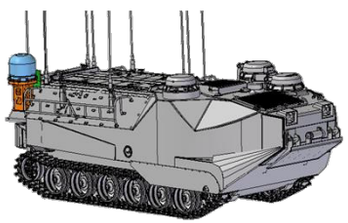
Research Area

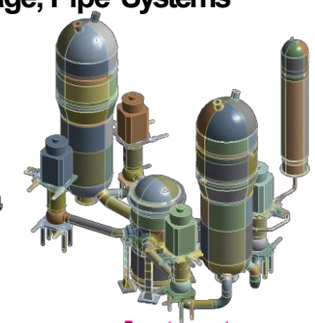
- ❑ Structural Vibration
- ❑ Multiphysics Vibration
- ❑ Haptic Feedback System
- ❑ Actuator
- ❑ Optical Measurement

Structural Vibration

- Advanced Automobile Noise and Vibration
- Nonlinear Vibration of Nuclear Reactor, Fuel Storage, Pipe Systems
- Shock and Vibration of Defense Systems

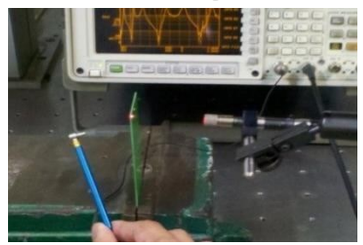


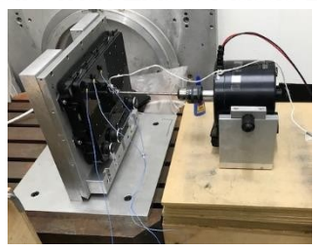


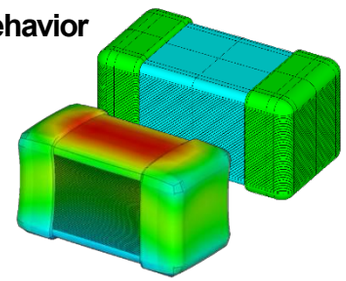


Multiphysics Vibration

- Vibration and Acoustic Noise Control for IT Devices
- Vibration of Components with Dielectric Materials
- Vibration Analysis of Structure with Elasto-Plastic Behavior



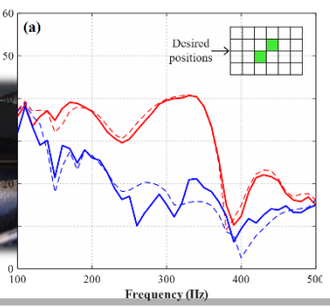




Haptic Feedback System

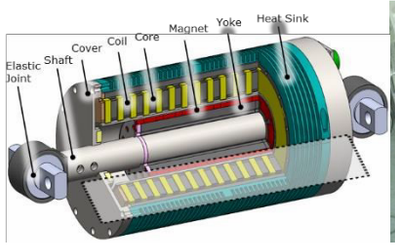
- Haptic Rendering and Acoustic Noise Reduction
- PZT Haptic Actuator Design

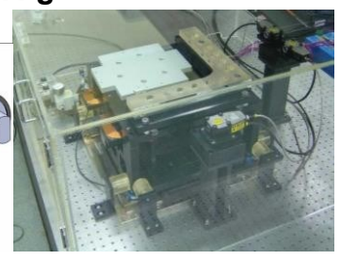




Actuator

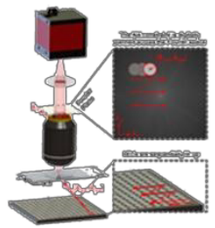
- Coupled Field Analysis of Actuators
- Structural Analysis and Design



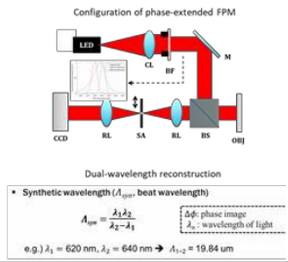


Optical Measurement

- Fourier Ptychography
- Color Measurement with Surface Geometry



Typical configuration of FPM



ICE & Clean Energy Lab
내연기관 & 청정에너지 연구실

http://engine.yonsei.ac.kr http://cleanenergy.yonsei.ac.kr

Yonsei University
School of Mechanical Engineering



송 순 호
(Soonho Song, Ph. D)

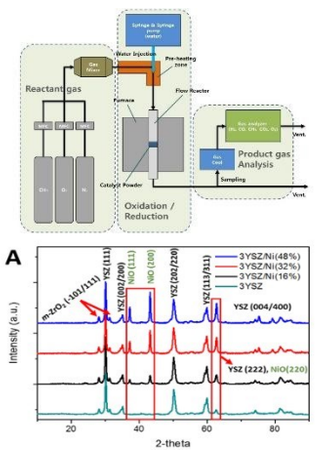
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Research Area

- ❑ Fuel Reforming
- ❑ Improving efficiency of gasoline engine using hydrogen
- ❑ Engine Simulation
- ❑ Combustion & chemical reaction
- ❑ Combustor Simulation

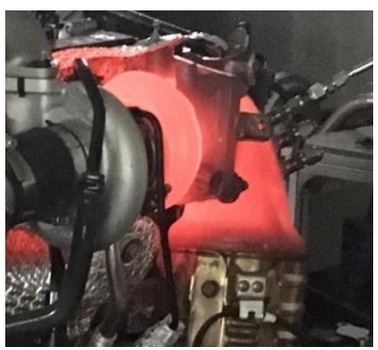
Fuel Reforming

- Synthesis and characterization of oxygen carrier/catalysts for hydrogen production
- Analysis of reaction kinetics



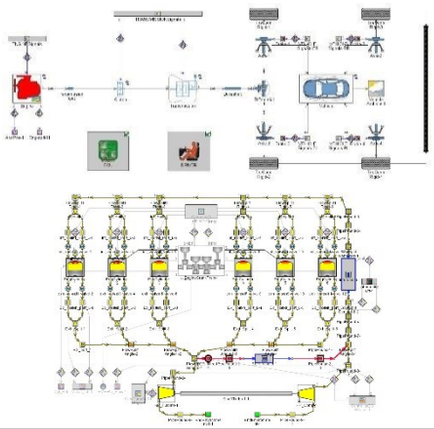
Improving efficiency of gasoline engine using H_2.

- Investigating hydrogen effect on combustion characteristics of T-GDI engine.
- Study of application method of hydrogen addition on vehicle for improving efficiency.



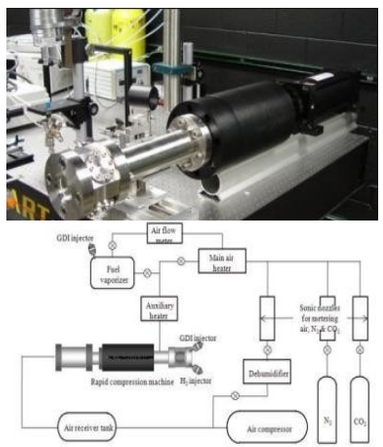
Engine Simulation

- Combustion and performance analysis by engine and vehicle modeling
- Combustion analysis on natural gas-diesel dual fuel engine



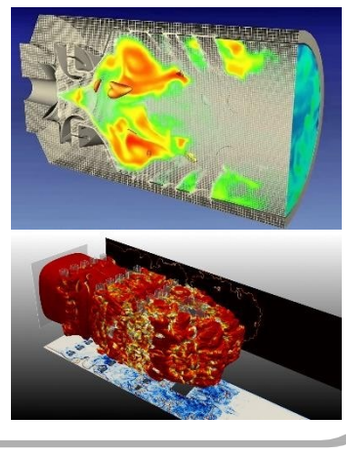
Combustion & Chemical Reaction

- Analyzing the combustion phenomenon using Rapid Compression Machine.
- Numerical analysis of the chemical kinetics



Combustor Simulation

- LESfor combustion within the gas turbine reactor.
- Improving a efficiency of combustion the flow analysis



Human-Centered Robotics Lab

인간중심 로봇공학 연구실

http://hcr.yonsei.ac.kr

Yonsei University
School of Mechanical Engineering



신동준 교수

(Dongjun Shin, Ph. D.)

제 3공학관 426호

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- Soft Actuators, Sensors, Wearables
- Human-Robot Hybrid Actuation, AI-based Motion Control
- Human Motion Analysis and Evaluation
- Assistive/Rehab Robot, Robotic Mobility, Collaborative Robot

Alchemist Project (Soft Wearables)

- Soft Robotic Suit, running 100m in 7sec

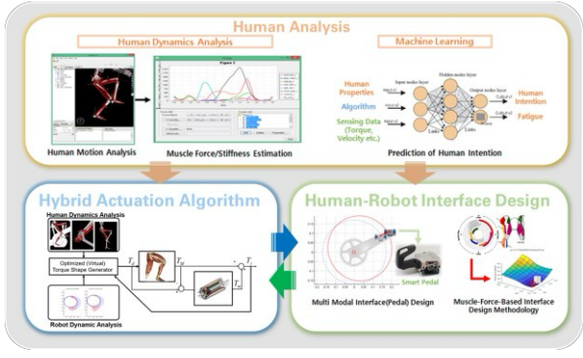




BeAgain Project (Robotic Mobilities)

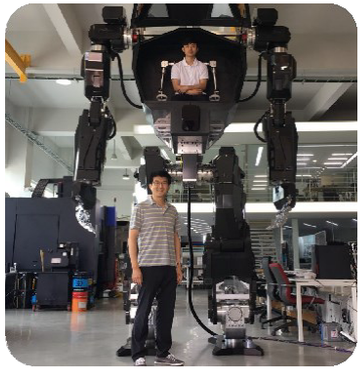
- Robotic Bike /Cybathlon (Rehabilitation Robot Olympic in Swiss, 2024)

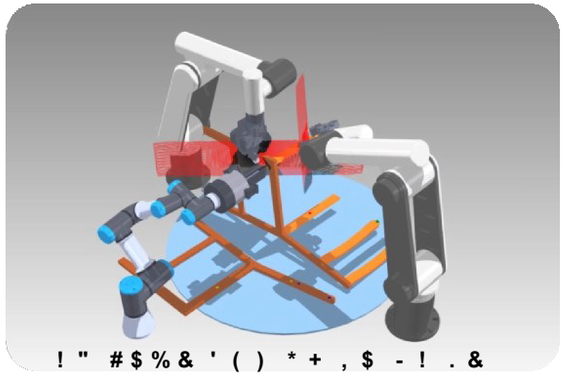




BigMan Project (Co-Robot Manipulation)

- Large-Scale Robot /AI-based Assembly Robot





Human+ Project (Assistive/Rehab Robots)

- Soft Smart Sleeve /Spine-Assistant Robot /Bio-inspired Prosthetic Arm







Micro Servo System

정밀제어시스템 연구실

http://mservo.yonsei.ac.kr

Yonsei University

School of Mechanical Engineering



양 현 석

(Hyun Seok Yang, Ph. D)

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Email : hsyang@yonsei.ac.kr

Research Area

Field of Interest

- Mobile Robot / Manipulator / Robotic Hand

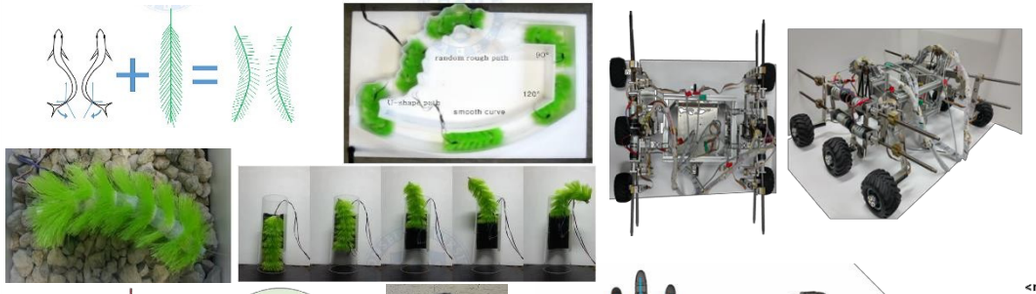
❑ Robot Mechanism Design & Manufacture

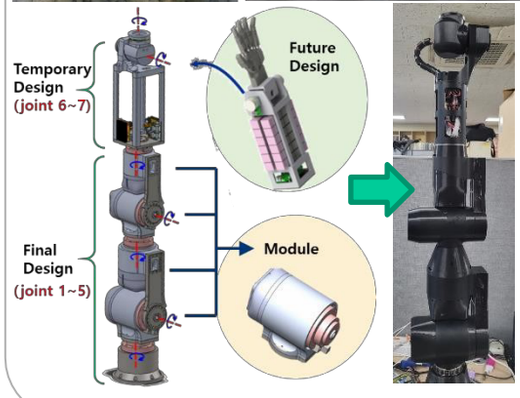
❑ Robot System Control

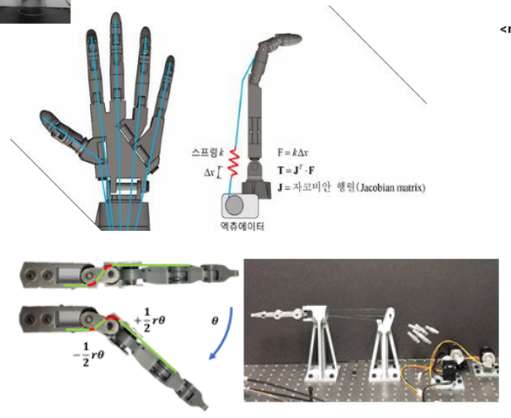
❑ Learning-based Intelligence Control

Robot Mechanism Design & Manufacture

- Mobile robots / manipulator / robotic hand

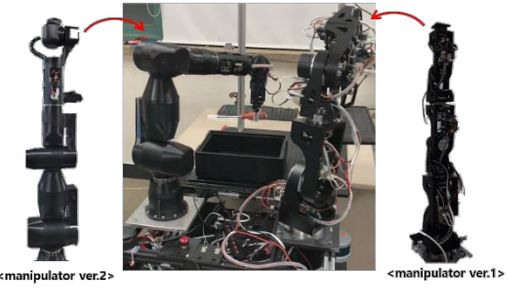




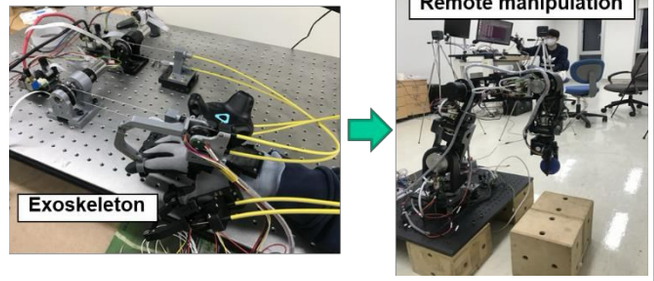


Robot System Control

- Dual arm manipulation

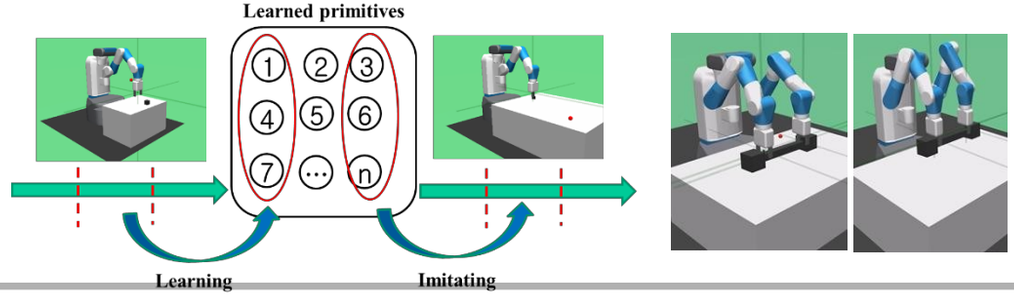


- Haptic & Teleoperation



Learning-based Intelligence Control

- Single/dual arm reinforced learning



Computational Structural Design & Optimization Lab

전산구조설계 연구실

http://ssd.yonsei.ac.kr

Yonsei University

School of Mechanical Engineering



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(Yoo, Jeonghoon Ph. D)

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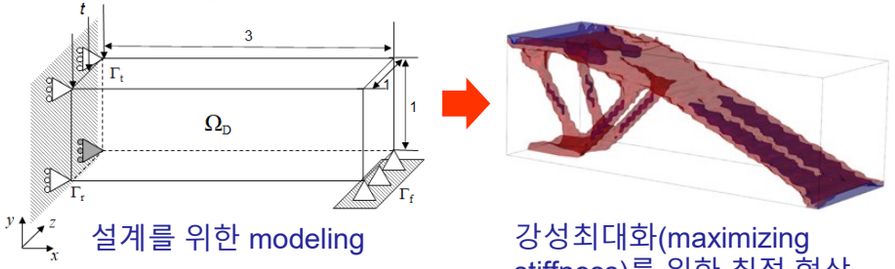
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Research Area

- ❑ **Machine Learning**과 위상최적화 방법을 이용한 구조물 경량 설계
- ❑ 전자기장**(Electromagnetic fields)** 내 성능 향상을 위한 구조설계
- ❑ 다목적**(multi-objectives),** 다중 스케일 **(multi-scale)** 구조의 설계

다중 재료(multi-material)를 이용한 위상최적설계 (Topology optimization) 기반의 구조 경량화



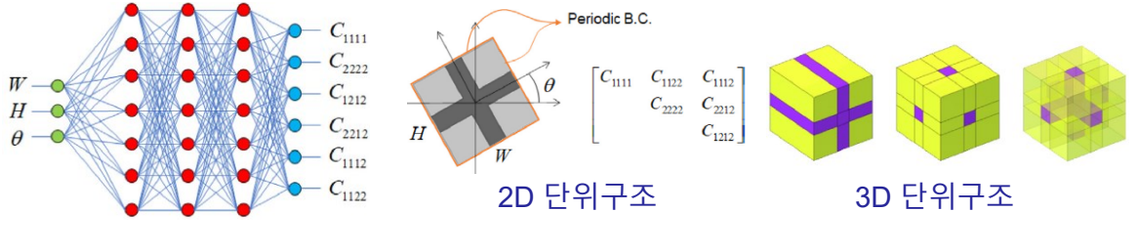
설계를 위한 modeling

강성최대화(maximizing stiffness)를 위한 최적 형상

(Ref: *Int J Numer Methods Eng*. 2019;**119**:334–360)

Machine Learning과 위상최적화를 이용한 구조설계

- 대표 체적요소법(RVE)과 ML을 이용한 물성치 module의 구성



2D 단위구조

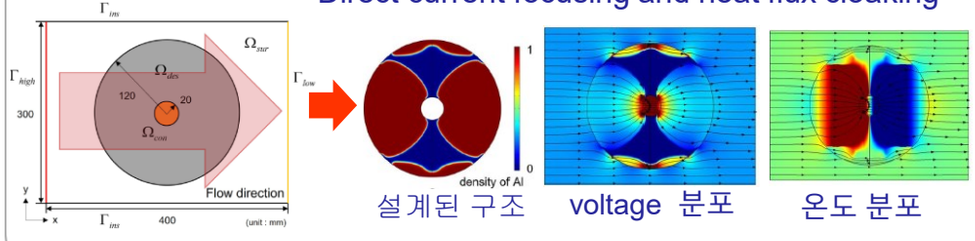
3D 단위구조

Young's modulus 도출을 위한 ML module의 생성

(Ref: *Comput Methods Appl Mech Engrg*. 2021;**387** 114158)

전자기(Electromagnetic, EM) 성능 향상을 위한 구조 설계

Direct current focusing and heat flux cloaking



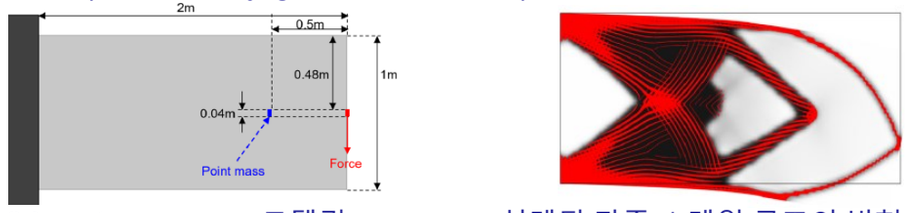
설계된 구조

voltage 분포

온도 분포

(Ref: *Struct Multidisc Optim*. 2022;**65**:292)

- Micro-macro scale을 고려한 다중목적(multi-objective) 기능적 등급구조(functionally graded structure)의 설계



2D cantilever beam 모델링

설계된 다중 스케일 구조의 변형 형상

(Ref: *Comput Methods Appl Mech Engrg*. 2024;**425** 116928)

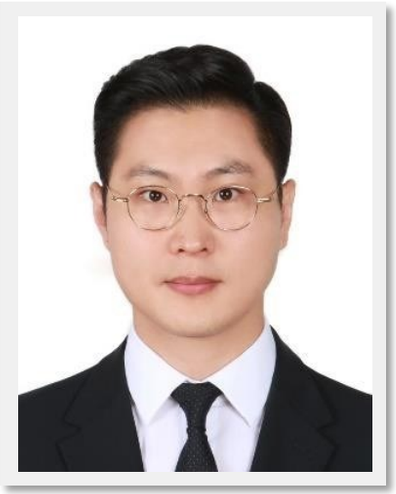
REsearch Laboratory of M²anufacturing Mechatronics

Control-Versatile Design for Intelligence & Precision

정밀 생산 메카트로닉스 연구실

(Group webpage under construction)

Yonsei University
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윤 준 영

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TEL : (02) 2123-2817

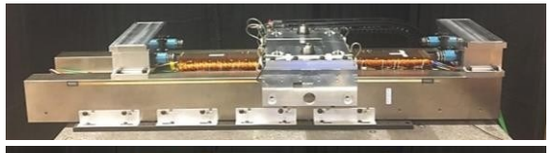
Email : junyoung.yoon@yonsei.ac.kr

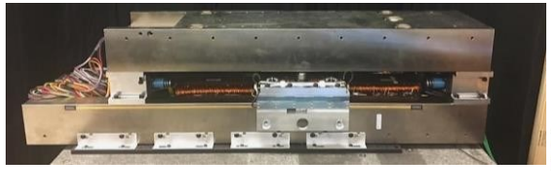
Research Area

- ❑ Intelligent manufacturing mechatronics and robotics system design
- ❑ Novel motor design and fault-control for electric cars & intelligent robots
- ❑ Mechatronics platform design and manufacturing for organ-on-a-chip
- ❑ Precision system design and control

Novel Motor Electro-Magnetic Design and Control

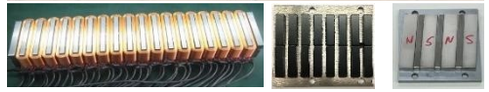
Intelligent manufacturing / Electric cars / Robots / Fault-tolerance





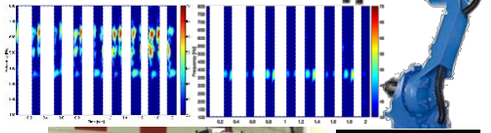
High-performance high-efficiency rotary motors
Fault-tolerant, intelligent, and safe motors





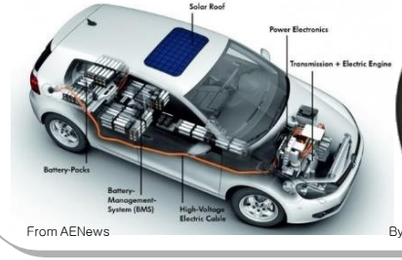
High-force low-noise linear motor

1) >90% noise reduction
2) >60% shear stress increase



[Industrial robot]

[Centralized electric motor]

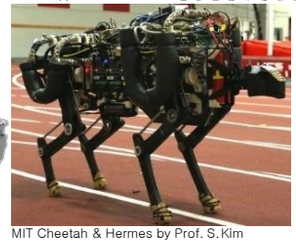


From AENews

[In-wheel motor]



By Protean

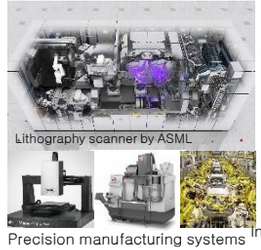




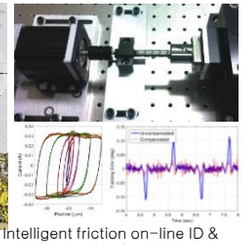
MIT Cheetah & Hermes by Prof. S. Kim

Precision Manufacturing Mechatronics System

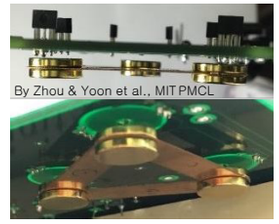
Friction microdynamics / Intelligent compensation / Actuator



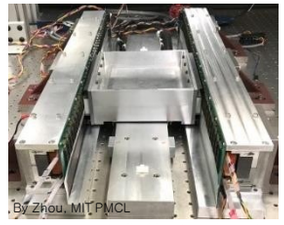
Precision manufacturing systems



Intelligent friction on-line ID & compensation for high-accuracy



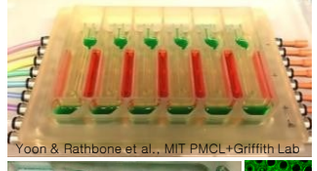
Magnetic levitation/ Active bearings

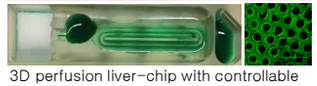


Linear pos-controlled hysteresis motor for in-vacuum transportation

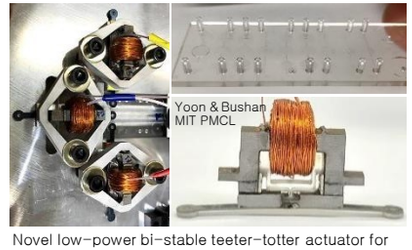
Bio-platform Design, Manufacturing, and Control

Micro-physiological reactors / Bio-environment / Organ-on-a-chip

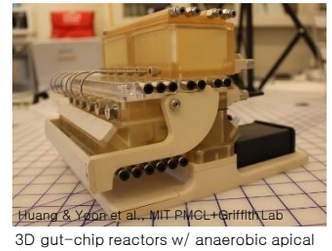




3D perfusion liver-chip with controllable oxygenator & reduced media volume



Novel low-power bi-stable teeter-totter actuator for organ-on-a-chip micropumps and active valves



3D gut-chip reactors w/ anaerobic apical & aerobic basal to study micro-biomes

Heat Transfer & Thermal Design Lab.

열전달 및 열설계 연구실

https://sites.google.com/view/httd-yonsei

Yonsei University

School of Mechanical Engineering



이 남 규

(Lee, Namkyu, Ph. D)

OFFICE : 제 1공학관 N207호

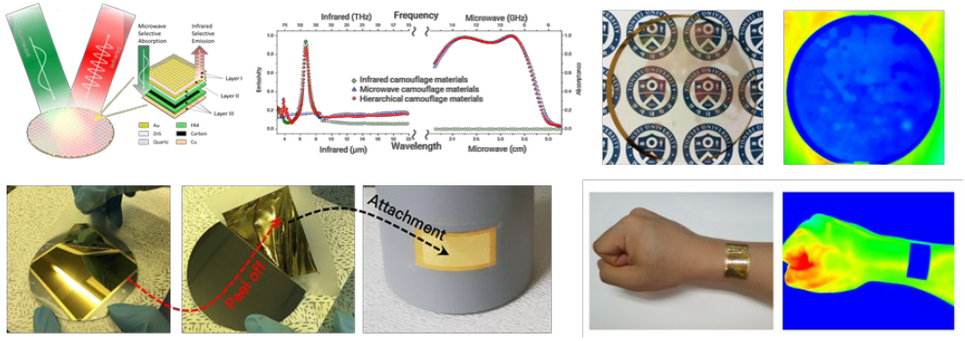
TEL : (02) 2123-2820

Email : nk.lee@yonsei.ac.kr

Research Area

- ❑ Thermal metamaterials
- ❑ Advanced heat transfer
- ❑ Thermal design
- ❑ Transport phenomena

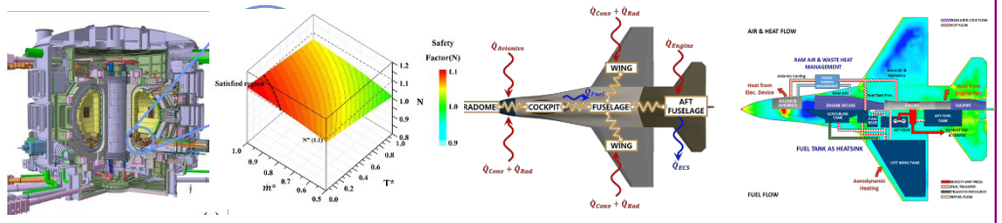
Thermal metamaterials



Thermal design

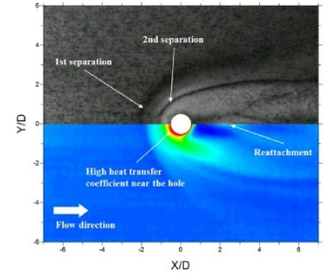
Nuclear fusion reactor

Future defense mobilities

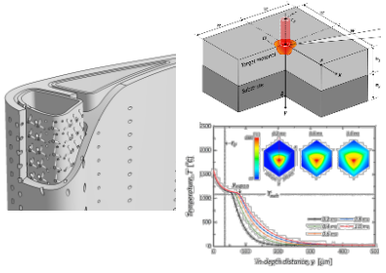


Advanced heat transfer

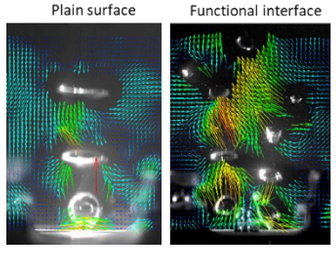
Supersonic



3D printing

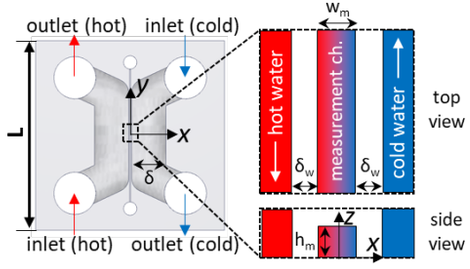


Phase change

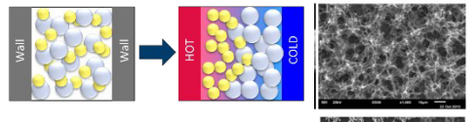


Transport phenomena - thermophoresis

Measurement development



Novel structures / materials



$$S_T = \frac{D_T}{D} = -\frac{1}{c(1-c)}\frac{\Delta c}{\Delta T}$$

Multi-Physics Design Optimization & Prognostics and Health Management Lab

멀티피직스최적설계 & 건전성진단예지 연구실

http://mdophm.yonsei.ac.kr

Yonsei University
School of Mechanical Engineering



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(Jongsoo Lee, Ph.D.)

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Email : jleej@yonsei.ac.kr

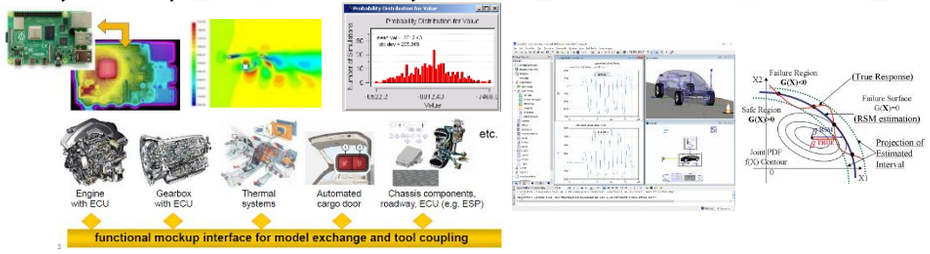
Research Area

- Reliability-Based Multi-Physics Design Optimization
- Prognostics and Health Management
- Generative Artificial Intelligence, Autonomous Multi-Agents
- Model Predictive Control, Physical AI

피로, 내구, 유동, 진동, 제어 성능에 대한
기계/메카트로닉스 부품 & 시스템의 확률통계·딥러닝 기반 신뢰성 진단
자율지능 멀티 에이전트, 피지컬 AI

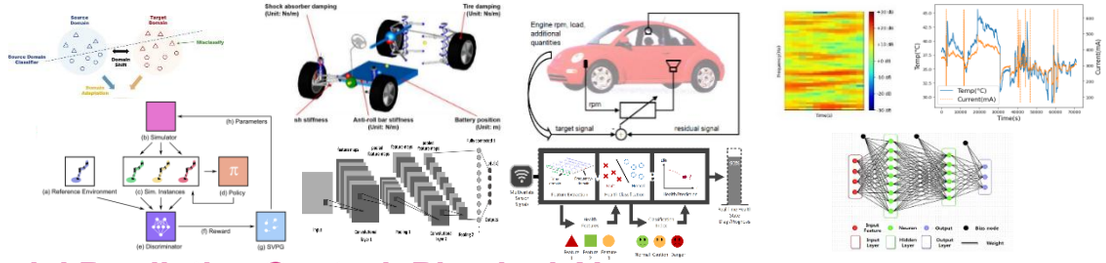
Reliability-Based Multi-Physics Design Optimization

CAE, MBSE, 신뢰성 최적설계, MCP기반 LLM 해석자동화 에이전틱 AI



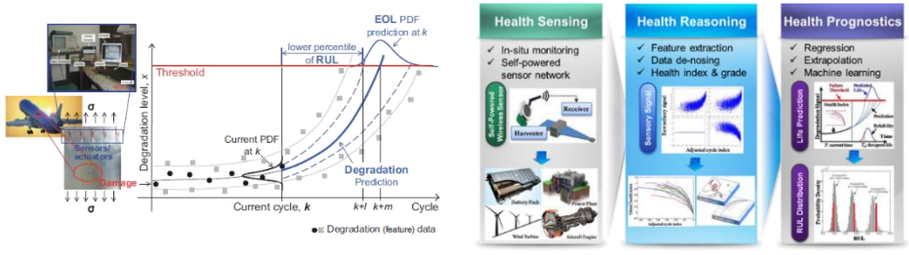
Generative Artificial Intelligence, Autonomous Multi-Agents

제네러티브 인공지능, 도메인 적응·도메인 일반화, 자율지능 멀티 에이전트



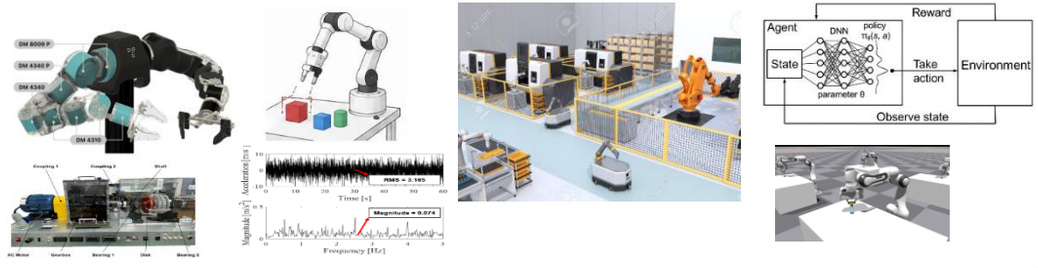
Prognostics and Health Management

건전성예측관리: 이상탐지, 고장진단, 상태기반 수명예지·처방정비



Model Predictive Control, Physical AI

모델·데이터기반 예측 제어, 피지컬 AI, vision-language-action (VLA)



Multi-scale Fluid Dynamics Lab.

멀티스케일 유체역학 연구실

http://mfdl.yonsei.ac.kr

Yonsei University

School of Mechanical Engineering

MFDL Homepage QR



이 준 상

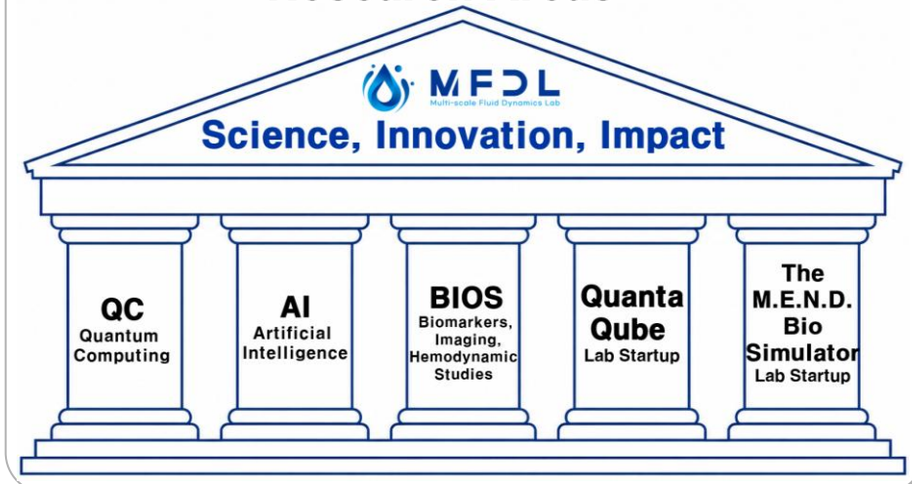
(Joon Sang Lee, Ph. D.)

OFFICE : 제 3공학관 327호

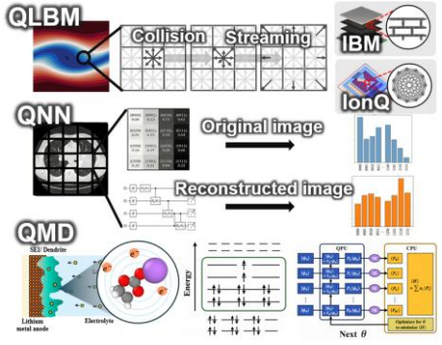
TEL : (02) 2123-5820

Email : joonlee@yonsei.ac.kr

Research Areas



QC

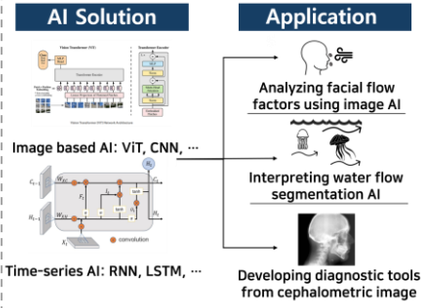


QLBM (Quantum lattice Boltzmann method)
- 양자 컴퓨팅 기반 격자 볼츠만 유동해석

QNN (Quantum neural network)
- 고차원 양자 공간 기반 영상 분류/예측

QMD (Quantum molecular dynamics)
- 양자 알고리즘 기반 분자/화학반응 에너지 계산

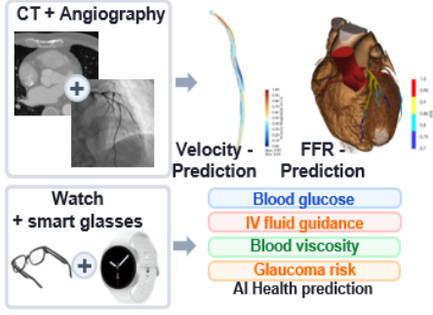
AI



Generative AI for Prognosis
- 치료 전 이미지 기반 의료 영상 예측
- 정밀 예측을 위한 모델 최적화

MIASfacial
- 단일 얼굴 2D 얼굴 영상 기반 3D 안면 재구성 및 주변 유동 CFD 분석

BIOS



CT- Based Hemodynamic Prediction
- 단일 CT 기반 AI 4D cardiac motion reconstruction
- CT 기반 혈류 및 FFR 정밀 예측

Wearable Health Monitoring
- 스마트 워치/ 글래스 기반 바이오마커/ 건강 상태 예측
- 혈당, 에너지 섭취, 수액 투여 필요성, 혈액점도 및 녹내장 위험 모니터링

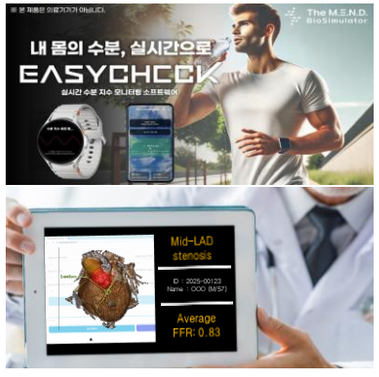
QuantaQube



(Q-LungCDSS) Quantum-AI lung cancer detection
- 저선량 CT 기반 폐암 진단 양자-고전 하이브리드 AI

(CephAI Pro Q) Quantum AI for Clinical Prediction
- 환자 별 치료 조건 기반 치료 후 예상 X-ray 예측

The M.E.N.D. BioSimulator



(CARDIOS) AI-Powered Cardiovascular Diagnosis
- AI 기반 비침습 심혈관 정밀 진단

(EASYCHECK) Health Monitoring
- 웨어러블 기반 실시간 바이오마커 및 수분 상태 모니터링

TURBULENCE Lab
난류 연구실
http://euler.yonsei.ac.kr

Yonsei University
School of Mechanical Engineering



이창훈

(Changhoon Lee, Ph. D)

OFFICE : 제1공학관 590호
첨단과학관 611a호

TEL : (02) 2123-6131, 2846

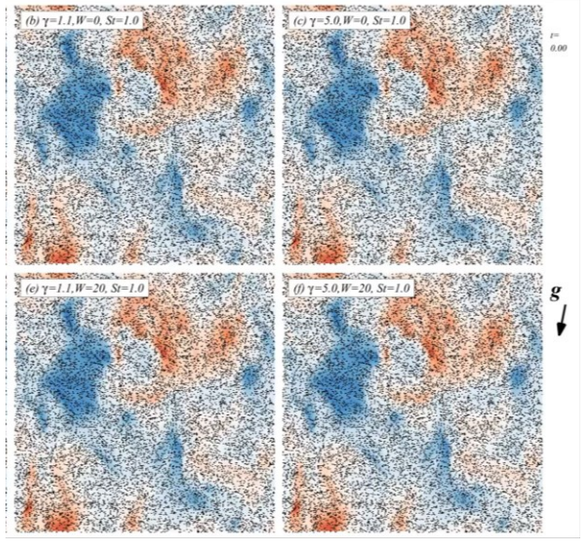
Email : clee@yonsei.ac.kr

Research Area

- ❑ Turbulence and particle-laden flow
- ❑ Deep learning of turbulence
- ❑ Energy and environmental applications
- ❑ CFD algorithm

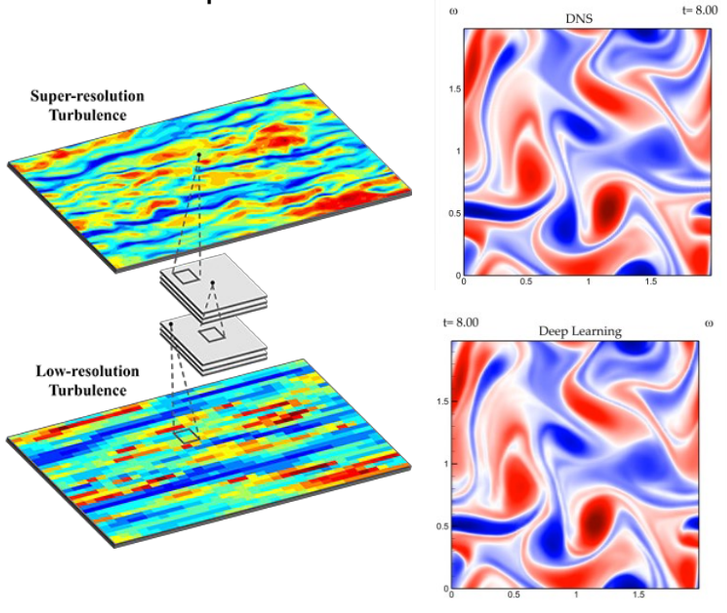
Turbulence & particle-laden flow

- Settling ellipsoidal particles in isotropic turbulence



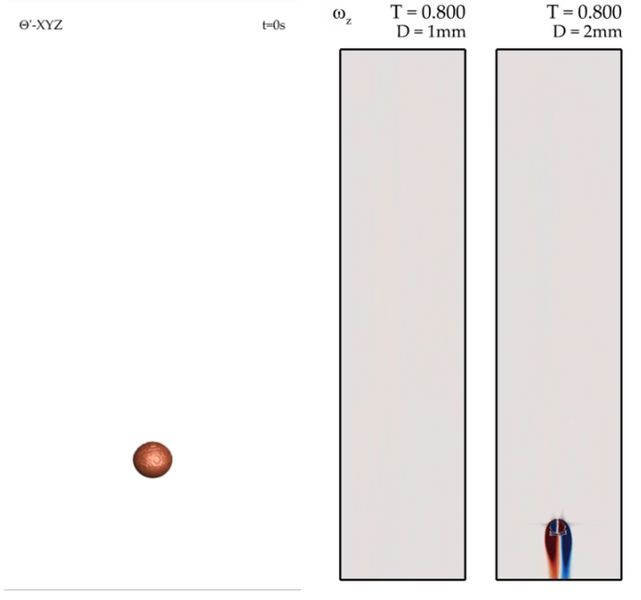
Turbulence deep learning

- Super-resolution reconstruction and prediction of 2D turbulence



Applications and algorithm

- Mushroom cloud simulation
- path instability of a bubble in turbulence



Mechanobiology & Soft Material Lab

생체역학 및 연성재료 연구실

http://leelab.yonsei.ac.kr

Yonsei University

School of Mechanical Engineering



이 형 석

Hyungsuk Lee, Ph. D

TEL : (02) 2123-5824

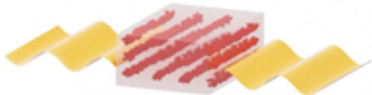
Email : hyungsuk@yonsei.ac.kr

Research Area

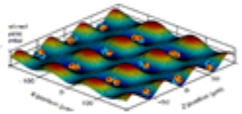
- ❑ Mechanobiology
- ❑ Acoustofluidics
- ❑ Mechanical Properties of Soft Materials
- ❑ Tissue Fabrication
- ❑ Biomimetic Energy System

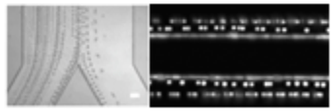
음향유체역학(Acoustofluidics) 응용

- 입자분리, 세포분리, 세포정렬, 음향장해석

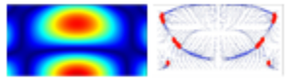


인공 조직 제작



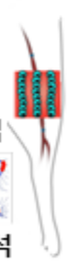


음향 유체를 이용한 세포 분리

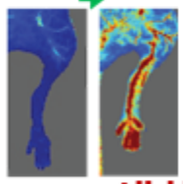


3차원 음향 유체 해석

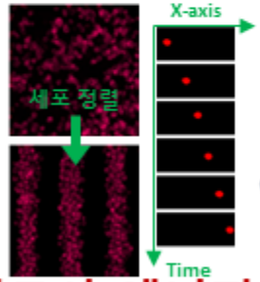
채널내 음향 유체 해석



제작된 인공 조직을 이용한 동물 실험

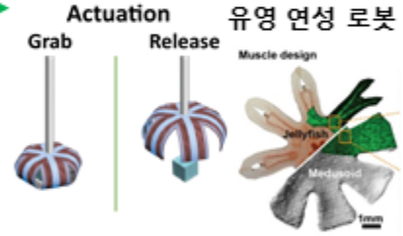


음향 유체를 이용한 고해상도 입자 조작

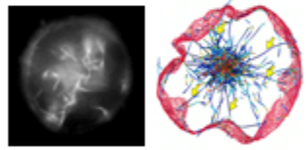


생체모사(Biomimetics) 로봇/센서

- 생체모사 연성로봇, 인공세포/동물 제작



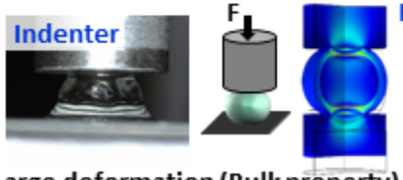
인공 세포 수축



- 세포 크기의 하이드로젤 제작
- 세포 골격 이용한 인공 세포
- 기계적 동적 거동 분석

연성 재료의 물리적 특성 측정

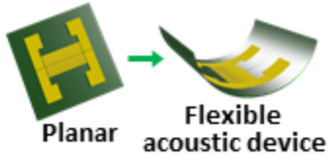
- Indentation, Aspiration, 유한요소해석



- Large deformation (Bulk property)
- Friction, wear test, hysteresis

FEM simulation

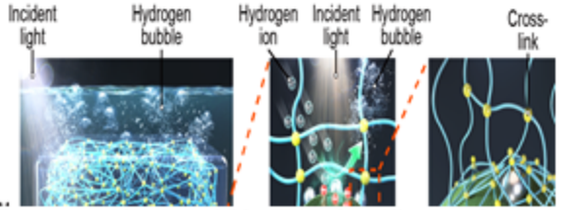
하이드로젤 조직, 폴리머



- Small deformation
- 탄성 및 점성 특성

생체모사 에너지 시스템

- 물분해, 그린 수소, 버블 dynamics

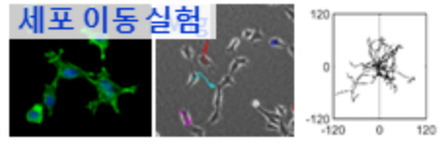


- 해조류 표면을 모사한 광수전분해 보호층
- Bubble dynamics in 기공 구조물 (porous structure)

세포 및 조직 역학

- 조직 공학, Organ on a Chip, 오가노이드







Micro Mechanics Lab
마이크로 역학 실험실

https://mcmclab.yonsei.ac.kr/index1.htm

Yonsei University
School of Mechanical Engineering



장 용 훈 교수

(Jang, Yong Hoon, Ph. D)

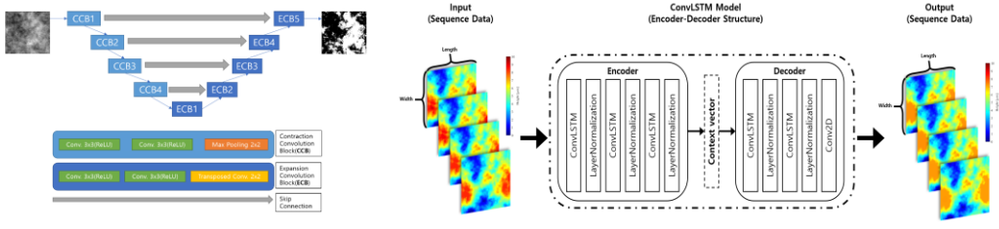
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Profile

- 2024 President, Korean Tribology Society(Korea)
- 2023 – Present, Associate Editor, Frontier in Mechanical Engineering
- 2019 – 2022, Associate Editor, Journal of Tribology(USA)
- 2014 – 2017, Editor, International Journal of Automotive Technology(Korea)

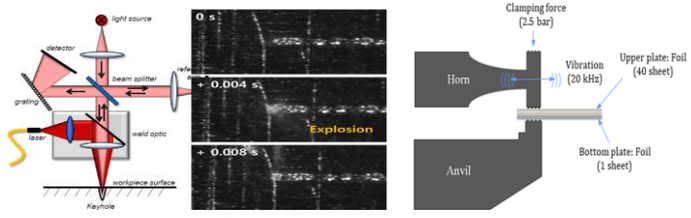
Artificial Intelligence for tribology

- Contact Distribution(CNN, GAN), Wear(LSTM) etc.

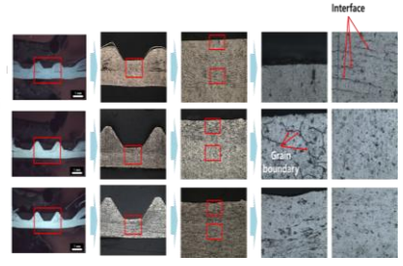


Battery Manufacturing

- Laser Welding, Ultrasonic Welding etc.



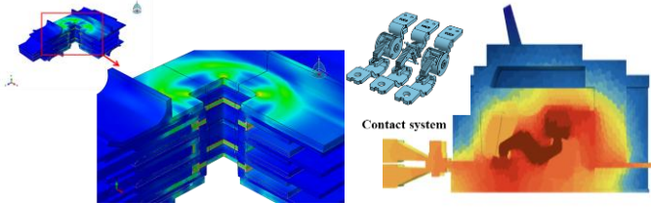
< Laser Welding >



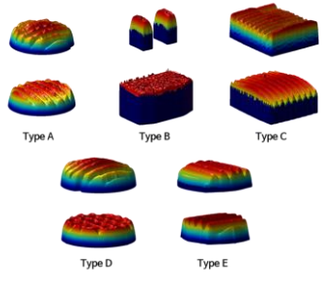
< Ultra Welding >

Elctrical Contact System

- Busduct system, Circuit Breaker, Realy etc.



< Thermal Simulation of Bus duct system/Circuit Breaker >

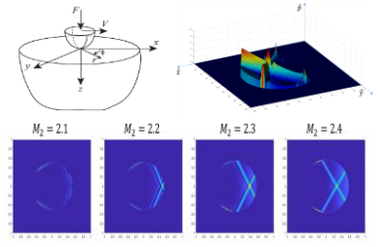


< Electrical Contact Tip Design >

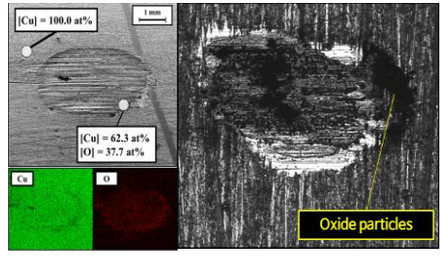
Contact, Friction & Wear Analysis



< Wedging >



< Sliding Behavior at Supersonic Speed >



< Thirdbody Wear >

NEMD Lab

나노 융합 소자 연구실

http://nemd.yonsei.ac.kr

Yonsei University

School of Mechanical Engineering



전성찬

(Seong Chan Jun, Ph. D)

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TEL : (02) 2123-5817

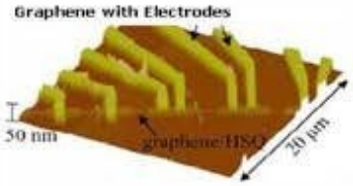
Email : scj@yonsei.ac.kr

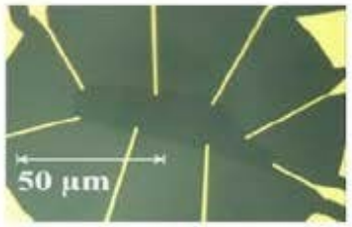
Research Area

- ❑ 2차원 나노 반도체 소자
- ❑ 초박막 충전 소자
- ❑ 인공지능 공기 센서
- ❑ 바이러스 진단 나노 센서

2차원 나노 반도체 (Semiconductor)

- 탄소 소자 및 2차원 물질의 나노 디바이스에 대한연구



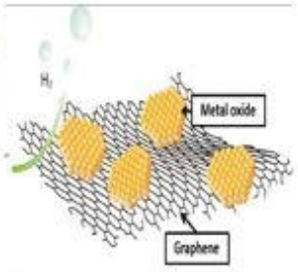




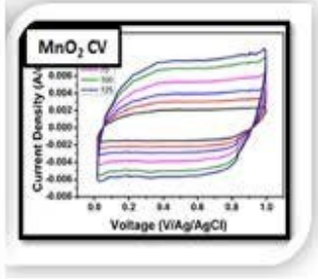
Graphene

초박막 충전 소자 전극 (Energy)

- 나노 소자를 이용한 에너지 저장 디바이스에 대한 연구

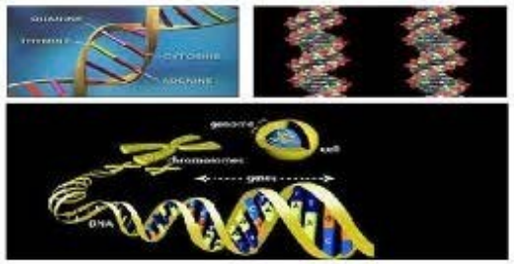


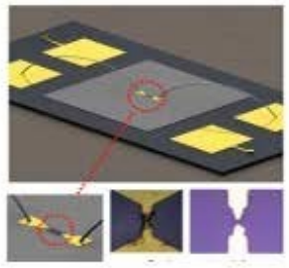




바이러스 진단 나노 센서

- 특정 바이오 물질을 나노 단위의 센서를 통해 검지





인공지능 유해 센서

- 유해 공기 감지 센서





Intelligent Structure Integrated Design Lab
지능형 구조 및 통합 설계
http://isid.yonsei.ac.kr

Yonsei University
School of Mechanical Engineering



전 흥 재
(Chun Heoung-Jae, Ph. D)

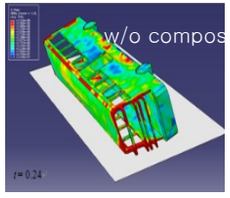
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Email : hjchun@yonsei.ac.kr

Research Area

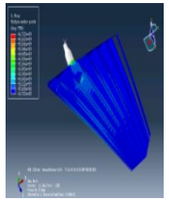
- ❑ Structural Design and Analysis (Composite Materials)
- ❑ Intelligent Materials and Structures
- ❑ Bio-mimetic and Biomechanics

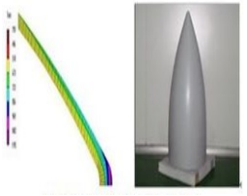
Structural Design and Analysis

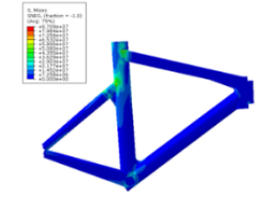
► Structural Analysis & Integrated Design, Shape & Function Optimization, Material Characterization, Micro and Macro Mechanics Models

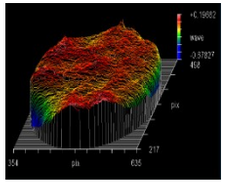


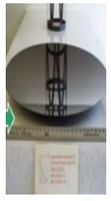
<CFRP Mirror Analysis>


<Aircraft repair Analysis>


<Development of Aircraft Radome>


<Cycle Analysis>

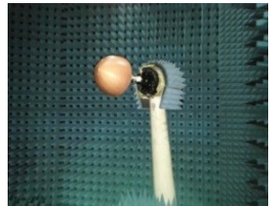

< Analysis of Surface Error Tool >


<CFRP Mirror Development >

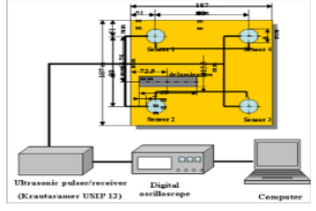
Intelligent Materials and Structures

► Active Control of Structures, Nondestructive Evaluation, Sensing and Actuation, Health Monitoring System


<Manufacturing Hybrid Composite>


<Development of Active FSS and Radome>

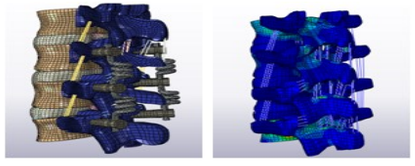

<Nano-composite stent>

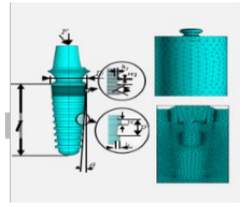


<Health Monitoring System>

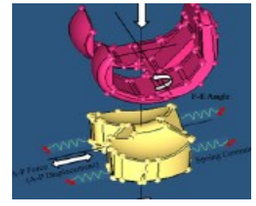
Bio-mimetic and BioMechanics

►Human Body Part Simulation Model Development, Surgical Simulation, Next Generation Implant System, Multi functional,Bio-materials, Bioreactor & Electro Spinning System, Differentiation of Adult Stem Cell


<Bone Mechanics>


<Implant Design>


<Bioreactor System>


<Knee implant>

Laboratory of Biochip Technology
바이오칩 연구실
http://nanobio.yonsei.ac.kr

Yonsei University
School of Mechanical Engineering



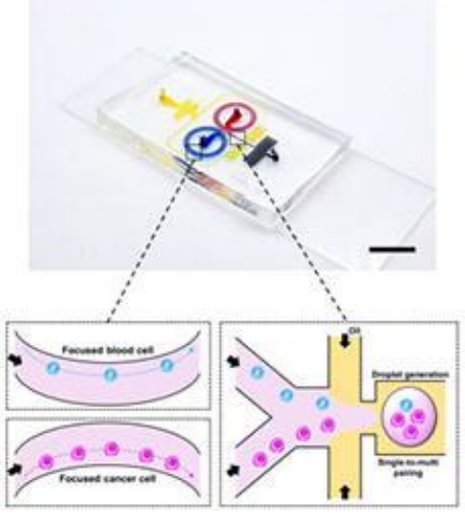
정 효 일
(Hyo-Il Jung, Ph. D)

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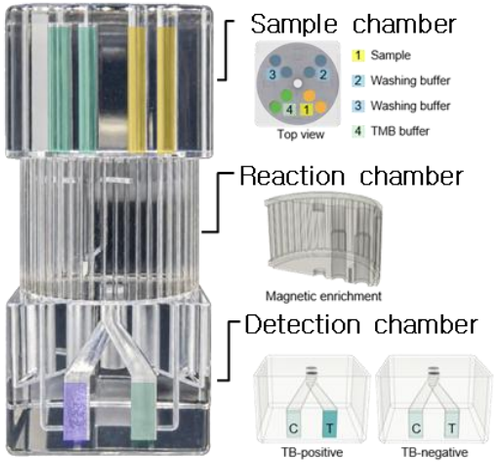
Research Area

- ❑ Microfluidics
- ❑ Biosensor
- ❑ Bio-Deep learning
- ❑ Lab automation

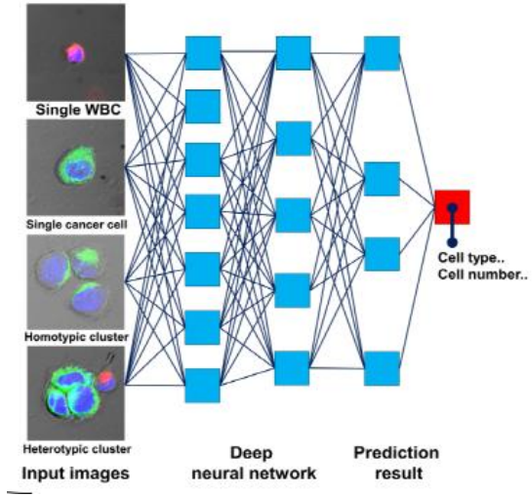
Microfluidics
의료용 미세유체칩 기술



Biosensor
진단용 바이오센서



Bio-Deep learning
센서 신호 분석/예측



Lab automation
첨단 의료용 자동화 장비

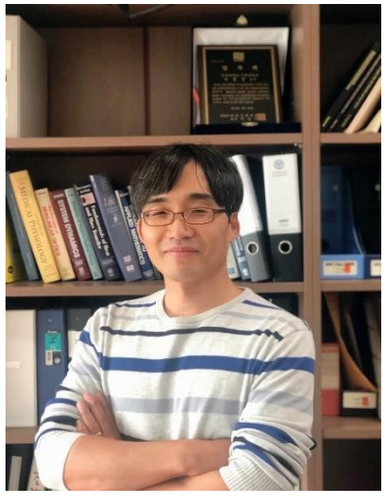


Computational Imaging & Instrumentation Laboratory

산술광학 영상 및 응용 연구실

(https://cii-yonsei.com/research/)

Yonsei University
School of Mechanical Engineering



주 철 민

(Chulmin Joo, Ph. D)

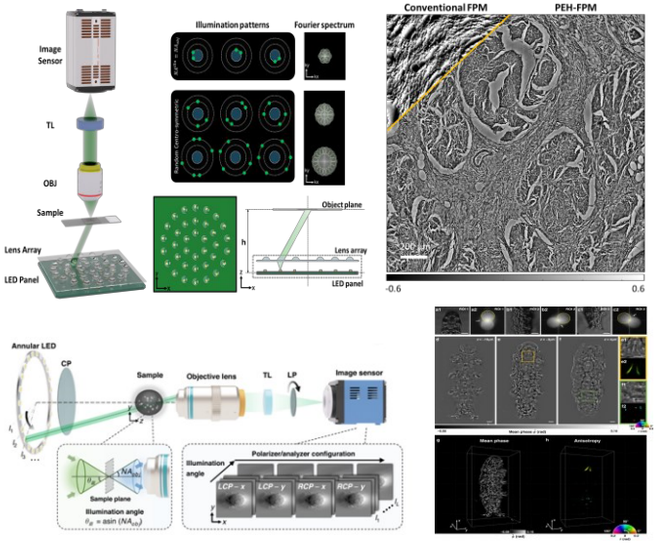
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Research Area

- ❑ Computational phase imaging
- ❑ Advanced microscopy for biomedical and industrial applications
- ❑ Biosensors
- ❑ Deep learning for computational Imaging

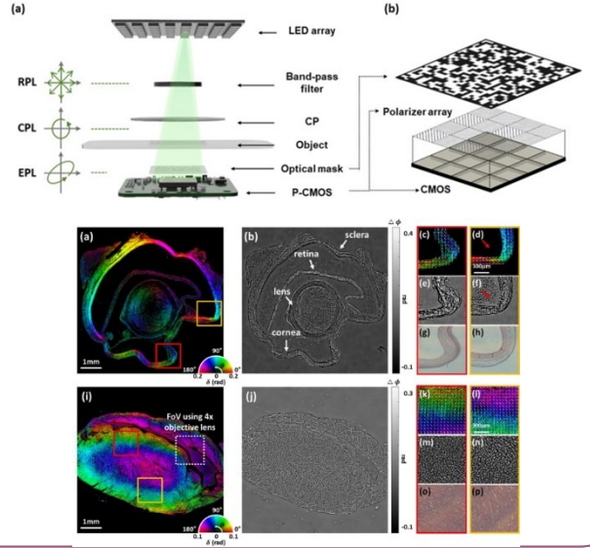
Computational phase imaging

- Develop optical imaging technologies by implementing computational methods and novel optical setup



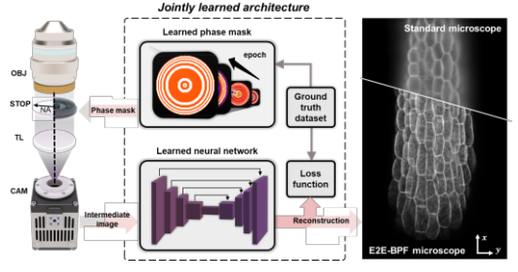
Advanced microscopy for biomedical and industrical applications

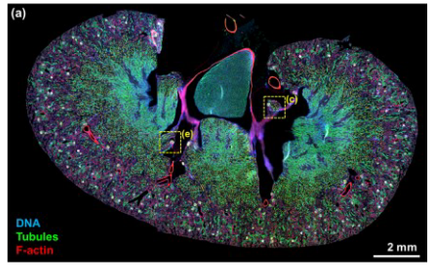
- Ptychographic lens-less birefringe microscopy using a mask modulated polarization image sensor



Deep learning for computational Imaging

- Extend depth-of-field using learning-based implementation of binary phase filter and image deconvolution





Machine Learning and Control Systems (MLCS) Lab
기계학습 및 제어 시스템 연구실

Yonsei University
School of Mechanical Engineering



최종은

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Research Area

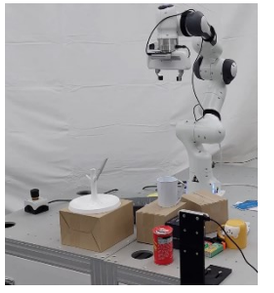
- ❑ **Inverse learning of autonomous driving**
- ❑ **Data efficient robot learning**
- ❑ **Motor control and HRI**
- ❑ **Control/System identification**
- ❑ **AI in healthcare**

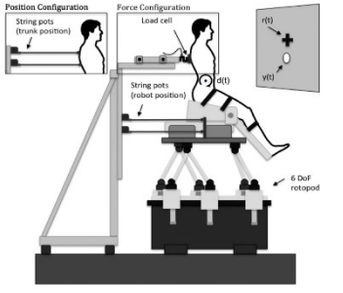
Inverse learning of autonomous driving





Robot learning/Human-Robot Interaction





Control/System Identification




AI in healthcare

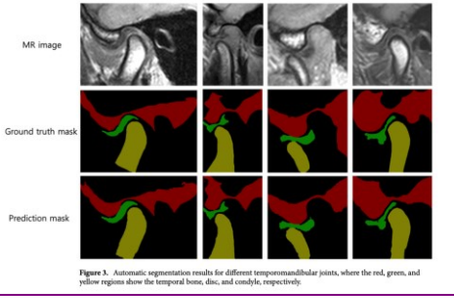
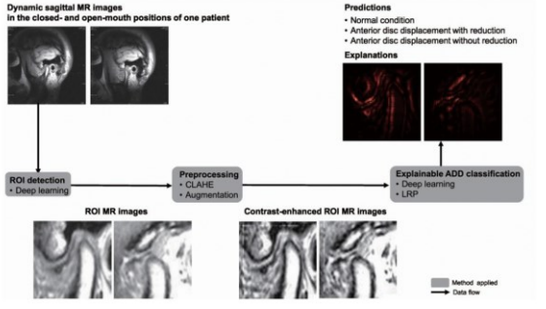


Figure 3. Automatic segmentation results for different temporomandibular joints, where the red, green, and yellow regions show the temporal bone, disc, and condyle, respectively.



High-dimensional Accurate Measurement & Intelligent Sensing Laboratory

정밀 측정 및 지능형 센싱 연구실

http://sites.google.com/view/damislab

Yonsei University
School of Mechanical Engineering



현재상

(Jae-Sang Hyun, Ph. D.)

OFFICE : 제 3공학관 315호

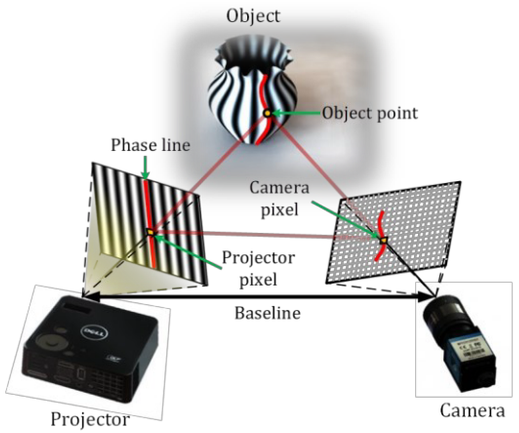
TEL : (02) 2123-2818

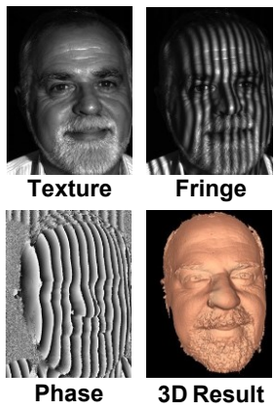
Email : hyun.jaesang@yonsei.ac.kr

Research Area

- ❑ 3D Optical Sensing / Superfast 3D Imaging
- ❑ Machine Vision / Machine Learning
- ❑ Robotics and Autonomous Vehicle Sensor
- ❑ Sensor & Pattern Algorithm Development
- ❑ 3D Data Compression / Video Communication

Digital Fringe Projection System



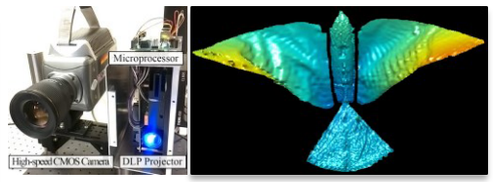


Vision-based 3D Scanning System

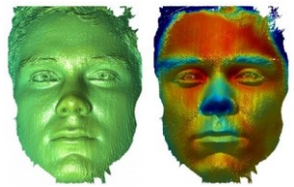




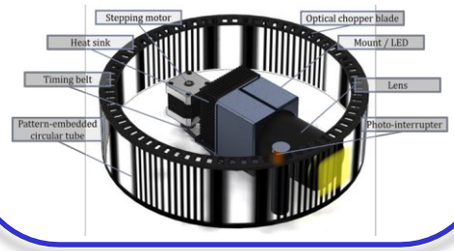
Superfast 3D imaging



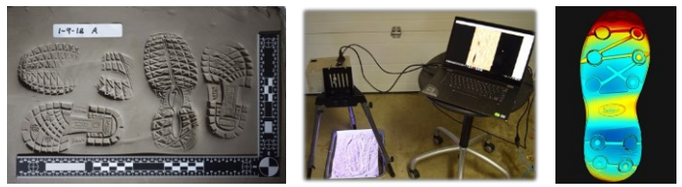
Multimodal Imaging



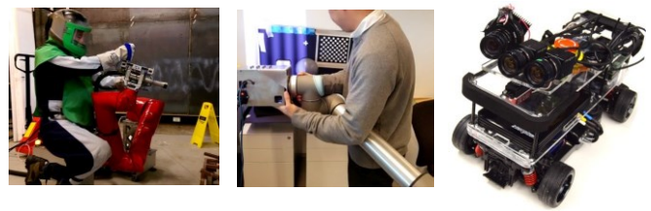
Next-Generation Sensors



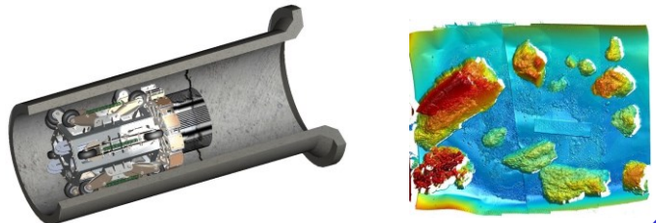
Forensic Science



Robotics and Autonomous Vehicle



Infrastructure Inspection



Multiphysics Energy System Laboratory

지속가능한 에너지 플랫폼 개발

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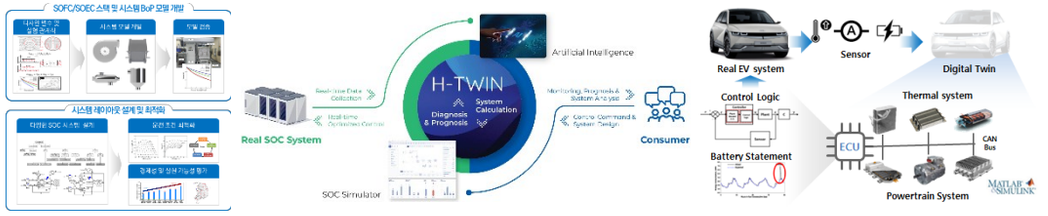
Email : jongsup.hong@yonsei.ac.kr

Research Area

- ❑ Novel & renewable energy system techno-economic analysis
- ❑ Thermo-electrochemical energy conversion device design
- ❑ Heat & mass transport management
- ❑ Environmentally-benign fuel utilization & process optimization

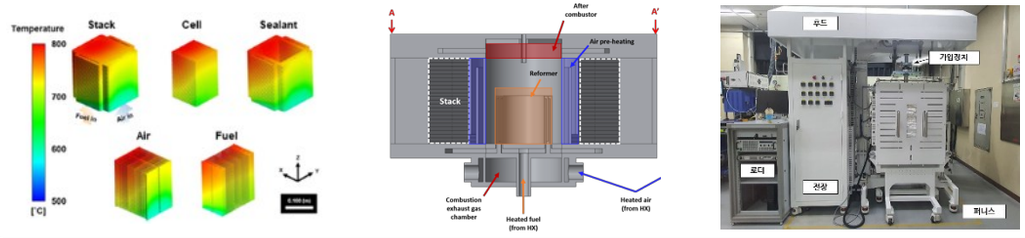
Thermodynamic System

- SOFC&SOEC system / xEV system / Digital twin



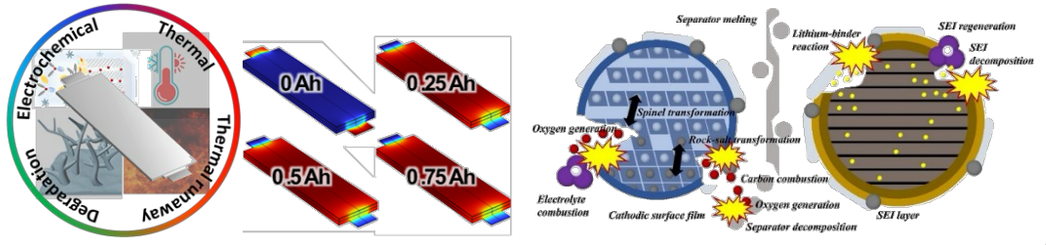
Hydrogen & Fuel cell

- Stack & hot-box simulation/ Design / Stack evaluation



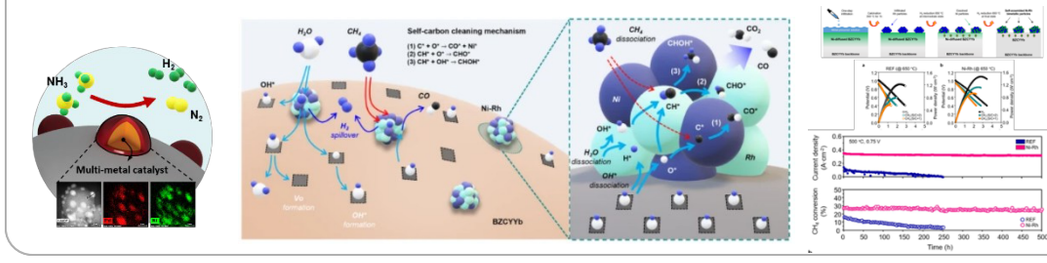
Lithium-ion Batteries for Electric Vehicles

- Multiphysics simulation / Thermal runaway / Safety



Reaction Engineering

- Catalysis / SOC Electrode design / Cell evaluation



Thank You

