Biomedical Engineering Research
Biomedical engineering is a research area in the College of Engineering at UNLV experiencing sustained growth. Our faculty has been involved in many related activities over the last decade. The combination of experimental and computational facilities within the college is a basis for future collaboration with other entities in Southern Nevada.

We would like to introduce you to some of our researchers. Please feel to contact us if we can help with your projects and initiatives.

Dr. Rama Venkat
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Dr. Mohamed Trabia
Associate Dean, College of Engineering
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Biomedical Engineering
Research Areas of Expertise

- Biosensors and actuators design
- Computational fluid dynamics of airflow and cardiovascular blood flow
- Micro- and nano-fluidics
- Nanoparticle and bio-molecule assembly
- Indoor air quality and contaminant transport
- Medical imaging
- Computer-aided diagnostics systems
- Telemedicine
- Medical data compression
- Electroactive polymers for biomedical engineering

- Lab-on-a-chip technologies toward biomedical diagnostics and analysis
- Orthopedic biomechanics
- Prosthetics systems engineering
- Bone fixation systems design and analysis
- Human factors and ergonomics
- Human force measurement
- Mechanical characterization of bones
- Evaluation of new orthodontic methods and materials
- Analysis and prevention of injuries due to shock or impact loads
- Technologies for people with visual impairments
- Music and audio technologies
Why UNLV?

- Las Vegas is a dynamic city with a population that includes multiple ethnicities and age groups.
- Las Vegas has attracted several organizations that are active in medical research including:
  - University of Nevada School of Medicine
  - Cleveland Clinic Lou Ruvo Center for Brain Health
- In addition to the College of Engineering, multiple entities within UNLV have been active in advancing biomedical research:
  - School of Allied Health Sciences
  - School of Community Health Sciences
  - School of Dental Medicine
  - School of Medicine
  - College of Sciences
- We continue to focus on establishing synergy between these entities to advance scientific knowledge and strengthen the economy of Southern Nevada.
Faculty Involved in Biomedical Engineering Research

Dr. R. Jacob Baker  
Professor, Department of Electrical and Computer Engineering

Dr. Yi-Tung Chen  
Professor, Department of Mechanical Engineering  
Co-Director, Center for Energy Research

Dr. Sarah Harris  
Associate Professor, Department of Electrical and Computer Engineering

Dr. Kwang J. Kim  
NV Energy Professor of Energy and Matter, Department of Mechanical Engineering

Dr. Shahram Latifi, P.E.  
Professor, Department of Electrical and Computer Engineering  
Co-Director, Center for Information Technology and Algorithms (CITA)

Dr. Samir Moujaes  
Professor, Department of Mechanical Engineering

Dr. Edward Neumann, P.E., C.P., FAAOP  
Professor Emeritus, Department of Civil and Environmental Engineering and Construction

Dr. Brendan O’Toole  
Chair and Professor, Department of Mechanical Engineering  
Director, Center for Materials and Structures

Dr. Darrell Pepper  
Professor, Department of Mechanical Engineering  
Director, NV Center For Advanced Computational Methods

Dr. Emma Regentova  
Professor, Department of Electrical and Computer Engineering

Dr. Andreas Stefik  
Assistant Professor, Department of Computer Science

Dr. Mohamed Trabia  
Professor, Department of Mechanical Engineering  
Associate Dean for Research, Graduate Studies & Computing

Dr. Evangelos Yfantis  
Professor, Department of Computer Science

Dr. Woosoon Yim  
Professor, Department of Mechanical Engineering  
Director of Intelligent Structures and Control Laboratory

Dr. Hui Zhao  
Associate Professor, Department of Mechanical Engineering
Biomedical Engineering Research

Additional Resources

- UNLV School of Allied Health Sciences
- UNLV School of Community Health Sciences
- UNLV School of Dental Medicine
- UNLV School of Medicine
- UNLV College of Sciences
- Cleveland Clinic Lou Ruvo Center for Brain Health
Biomedical Engineering

Research Highlights
Biomedical Engineering Research

R. Jacob Baker
Professor, Department of Electrical and Computer Engineering
Phone: (702) 895-4125
Email: R.Jacob.Baker@unlv.edu

• Expertise
  • Digital microfluidics
  • Electrowetting
  • Capacitive sensing
  • Droplet position detection of immunohistochemistry experiments
  • Capacitance to digital conversation for biological imaging
  • CMOS integrated circuit microfluidics
Biomedical Engineering Research

R. Jacob Baker
Professor, Department of Electrical and Computer Engineering

Recent Publications

Biomedical Engineering Research

Dr. Yi-Tung Chen  
Professor, Department of Mechanical Engineering  
Co-Director, Center for Energy Research  
Phone: (702) 895-1202  
Email: Yitung.Chen@unlv.edu  

- Expertise  
  - Pulmonary air flow and cardiovascular blood flow modeling  
  - Biosensor design  
  - Pharmacokinetics  
  - Biomolecular simulation  
  - Computational fluid dynamics  
  - Computational heat transfer and mass transfer  
  - Medical image processing  
  - Fluid and structural interaction
Dr. Yi-Tung Chen
Professor, Department of Mechanical Engineering
Co-Director, Center for Energy Research

Recent Projects
• Computational fluid dynamics (CFD) studies of airflow in a digital reference model of the 17-generation airway (bronchial tree) were accomplished using numerical modeling, based on the anatomical model.
• The lung model consists of $6.74 \times 10^6$ unstructured tetrahedral computational cells. A steady-state airflow rate was used to simulate the transient turbulent flow regime using a large eddy simulation turbulence model.
• The nature of the secondary vortical flows, which develop in such asymmetric airways, was demonstrated to vary with the specific anatomical characteristics of the branching conduits.

Recent Publications
Dr. Sarah Harris
Associate Professor, Department of Electrical and Computer Engineering
Phone: (702) 895-4518
Email: Sarah.Harris@unlv.edu

• Expertise
  • Digital design, reconfigurable computing
  • System on a chip design
  • Embedded systems
  • Robotics, interfacing sensors, actuation
Biomedical Engineering Research

Dr. Sarah Harris
Associate Professor, Department of Electrical and Computer Engineering

Recent Publications

• Kakakhel, Z., Owen, R., Harris, S. and Harris, D., *MIPSfpga: An unobfuscated commercial MIPS core and SoC that runs Linux*, Embedded World Conference, February 2016, Nuremberg, Germany.
Dr. Kwang J. Kim
NV Energy Professor of Energy and Matter
Department of Mechanical Engineering
Phone: (702) 774-1419
Email: kwang.kim@unlv.edu
Web: www.kwangjinkim.org
Youtube: http://www.youtube.com/user/kwangkimlab
Publications:
http://scholar.google.com/citations?user=VX3wtWEAAAAJ&hl=en

- Expertise
  - Electroactive polymers for biomedical engineering

Fiber-embedded EAP catheter (collaboration with K. Leang and W. Kim)
Biomedical Engineering Research

Dr. Kwang J. Kim
NV Energy Professor of Energy and Matter
Department of Mechanical Engineering

Recent Publications


Biomedical Engineering Research

Dr. Shahram Latifi, P.E.
Professor, Department of Electrical and Computer Engineering
Co-Director, Center for Information Technology and Algorithms (CITA)
Phone: (702) 895-4016
Email: Shahram.Latifi@unlv.edu

- Expertise
  - Medical imaging
  - Computer-aided diagnostic systems
  - Data compression
Biomedical Engineering Research

Dr. Shahram Latifi, P.E.
Professor, Department of Electrical and Computer Engineering
Co-Director, Center for Information Technology and Algorithms (CITA)

Recent Projects

• “Cognitive Body Area Networks to Treat Obesity”, with Dr. Alona Angosta, School of Nursing, 2016.
• “Medical Image Compression”, A Graduate Class Project, 2014.

Recent Publications

Biomedical Engineering Research

Dr. Samir Moujaes
Professor, Department of Mechanical Engineering
Phone: (702) 895-3265
Email: Samir.Moujaes@unlv.edu

• Expertise
  • Testing Portable Body Temperature Conditioner (PBTC) with computer-aided diagnostics systems
  • Testing thermal manikin for performance of PBTC under various controlled conditions

Above: Portable body temperature conditioner (PBTC) developed by Rocky Research and tested by Nevada School of Medicine and UNLV

Right: Thermal manikin tested by UNLV for the performance of the PBTC under various controlled thermal conditions
Biomedical Engineering Research

Dr. Samir Moujaes
Professor, Department of Mechanical Engineering

Completed Research Projects:
• “Characterization of a Conditioning Hypothermic/ Hyperthermic Portable Device for use in Field Installations”, US Army Office, University of Reno School of Medicine, November 13-Jan. 2015, $52,000.

Recent Publications
Biomedical Engineering Research

Dr. Edward Neumann, P.E., C.P., FAAOP
Professor Emeritus, Department of Civil and Environmental Engineering and Construction
Phone: (702) 895-1072
Email: Edward.Neumann@unlv.edu

• Expertise
  • Direct prosthetic measurement using load cells
  • Biomechanics, prosthetics, and related areas
  • F-scan and F-socket pressure sensing systems and Vicon motion capture systems
  • Socket pressure and comfort, quantitative gait analysis, and load cell force-moment analysis
  • Orthotics research in energy storage and return for AFOs constructed from composite materials
  • Clinical experience in all aspects of patient management, including measurement, modification, fabrication, fitting, and repair
Recent Projects

- Clinical experience in all aspects of patient management including measurement, modification, fabrication, fitting, and repair of transradial cable operated prostheses; transtibial and transfemoral prostheses.

Recent Publications

Biomedical Engineering Research

Dr. Brendan O’Toole
Chair and Professor, Department of Mechanical Engineering
Director, Center for Materials and Structures
Phone: (702) 895-3885
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- Expertise
  - Development of low-cost prosthetic hands
  - Strength and stiffness of bones
  - Design and analysis of composite orthotics
  - Experimental evaluation of orthodontic devices
  - Mitigation of impact-induced injuries

In collaboration with the Dental School, investigation of the effects of location, shape, and orientation of attachments for the retention of thermoformed orthodontic aligners.

3D printed prosthetic hand for a 5-year old girl who has Poland Syndrome
Biomedical Engineering Research

Dr. Brendan O’Toole
Chair and Professor, Department of Mechanical Engineering

Recent Projects

• Development of low-cost prosthetic hands
• Characterization of orthodontic devices and materials
• Evaluating effect of hibernation on bone strength in ground squirrels
• Shock absorbing properties of elastomeric mouth pieces
• Experimental evaluation of the failure of solder joints in dental wire connections
• Shear testing of orthodontic brackets
• Retention of thermoformed aligners with varying mounting brackets
• Design and fabrication of polymer composite Ankle Foot Orthosis (AFO)
• Experimental evaluation of the performance of AFOs in situ and in a laboratory environment
• Computational analysis and geometric optimization of titanium mesh implant structures for facial reconstruction

Recent Publications

Biomedical Engineering Research

Dr. Darrell Pepper
Professor, Department of Mechanical Engineering
Director, Nevada Center for Advanced Computational Methods
Phone: (702) 895-1056
Email: Darrell.Pepper@unlv.edu

• Expertise
  • Computational fluid dynamics, heat transfer, and species transport
  • Advanced computational techniques
  • Multi-physics modeling
  • Indoor air dispersion modeling
  • Biomedical / environmental fluid dynamics

Top: Contaminant transport within porous media.
Center: Species transport within a room with an open door.
Bottom: Velocity contours within a femoral artery experiencing pulsatile flow.

Progression of atherosclerosis in an artery
Biomedical Engineering Research

Dr. Darrell Pepper
Professor, Department of Mechanical Engineering
Director, Nevada Center for Advanced Computational Methods

Recent Publications

Biomedical Engineering Research

Dr. Emma Regentova
Professor, Department of Electrical and Computer Engineering
Phone: (702) 895-3187
Email: Emma.Regentova@unlv.edu
Website: http://www.ee.unlv.edu/~regent/

- Expertise
  - Biomedical imaging
  - Hyperspectral imaging

Quantification of protein cells distribution in microscope images in injured muscles

Cancer research: Detecting microcalcifications in digital mammograms

High performance methods for sparse-view CT reconstruction
Compressive sensing: MRI reconstruction
Biomedical Engineering Research

Dr. Emma Regentova
Professor, Department of Electrical and Computer Engineering

Recent Publications


Dr. Andreas Stefik
Assistant Professor, Department of Computer Science
Phone: (702) 895-3187
Email: Andreas.Stefik@unlv.edu

- Expertise
  - Software engineering
  - Programming languages
  - Empirical study design
  - Statistics
  - Technologies for people with visual impairments
  - Music and audio technologies

Blind students at the Washington State School for the Blind learning to develop software by using the Quorum programming language.
Recent Publications


Biomedical Engineering Research

Dr. Mohamed Trabia
Professor, Department of Mechanical Engineering
Associate Dean for Research, Graduate Studies & Computing
Phone: (702) 895-0957
Email: Mohamed.Trabia@unlv.edu
Website: www.me.unlv.edu/~mbt

- Expertise
  - Optimization of human-powered vehicle design
  - Bone fixation systems design and analysis
  - Fingertip force measurement and characterization
  - Electronic Braille reading system
  - Characterization of diabetic ulceration
  - Characterization of material models of tissues

Top: A bone fixation device combines tension wire and bone plate methods to reduce and fixate a fracture.
Bottom: Configuration of Cartesian space to measure forces of the finger pad while reading Braille characters
Biomedical Engineering Research

Dr. Mohamed Trabia
Professor, Department of Mechanical Engineering
Associate Dean for Research, Graduate Studies & Computing

Recent Publications


Approved Patents

• 8,617,221, “Apparatus and methods for bone fracture fixation.”
• 7,578,835, “Apparatus and methods for bone fracture reduction and fixation.”
• 7,235,077, “Bone fixation device and method.”
Biomedical Engineering Research

Dr. Evangelos Yfantis
Professor, Department of Computer Science
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Website: www.ICIS.cs.unlv.edu

• Expertise
  • Medical images and video
  • Telemedicine
  • Computer simulation of human anatomy
  • Minimally invasive methods using computer vision
  • Computerized Medical Forms Detection, Medical Records Project (DOE)
  • HCI Computer Vision Project (NASA)
Biomedical Engineering Research

Dr. Evangelos Yfantis
Professor, Department of Computer Science

Recent Publications

Biomedical Engineering Research

Dr. Woosoon Yim
Professor, Department of Mechanical Engineering
Director, Intelligent Structures and Control Laboratory
Phone: (702) 895-0956
Email: Woosoon.Yim@unlv.edu

- Expertise
  - Biosensor and actuator development
  - Computational modeling of OSA (Obstructive Sleep Apnea)
  - Biomechanical study of upper airway morphology

An experimental setup used to measure viscoelastic properties of a pig’s lower jaw and tongue mounted on a BOSE Dynamic Material Tester

Patient’s CT Images (1 mm cut)
Mesh surface generation by Simpleware
ANYSIS computational Dynamics software for FSI

April 2017
Biomedical Engineering Research

Dr. Woosoon Yim
Professor, Department of Mechanical Engineering
Director, Intelligent Structures and Control Laboratory

Recent Publications

Biomedical Engineering Research

Dr. Hui Zhao
Associate Professor, Department of Mechanical Engineering
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- Expertise
  - Fundamentals of micro- and nano-fluidics
  - Electrokinetic transport
  - Properties of nanoparticles and biomolecules
  - Development of techniques using electric fields to sort, separate, and immobilize cells and biomolecules
  - Lab-on-a-chip devices for automatic, fast detection and diagnostics
  - Biosensing

Top: In nanopore-based DNA sequencing, the side where DNA is placed is termed *cis* and the other side is referred to as *trans*.
Bottom: The fluorescence image on a) a smooth silicon substrate and b) the substrate with nano-antenna.
Recent Publications