GRADUATE PROGRAMS

Ph.D. in Engineering Science and Mechanics
M.S. in Engineering Science and Mechanics
  • Thesis and non-Thesis Tracks
M. Eng. in Engineering Mechanics
M.D./Ph.D.
M.S. in Engineering at the Nanoscale
Mechanical anisotropy of 3D printed composite

Below: Carbon whisker composites manufactured through fused filament deposition

3D Printer (fused filament deposition)

Whisker and void morphology

Flat Unidirectional Specimens

[0]_8

[90]_8

Printing Head

Micromechanical modeling

PI: Dr. Charles Bakis
Mechanical anisotropy of 3D printed composite

Above: A set of resonators mounted on a plate reflect the incident wave

No transmission!

Incident wave

PIs: Drs. Shokouhi & Lissenden
Ultrasound allows nondestructive microscale characterization

PI: Dr. Andrea P. Arguelles

Above: Defect detection in metallic alloy; polycrystalline microstructure and corresponding ultrasonic scattering signals.
Additive manufacturing of shape memory alloys (SMAs)

Above: Hierarchical SMA structures; nano-/micro-/meso-scale test approaches to locally probe deformation mechanisms; performance of two compositions

PI: Dr. Reginald Hamilton
Wearable and degradable Devices

Above: Transient Sensor on Low-Cost Substrate for Implantable devices; Fully degradable 3D Electronics on Curvilinear Surfaces.

PI: Dr. Larry Cheng
Above: Understanding the neural control of blood flow and fluid movement in the brain using optical imaging and modeling.

PI: Dr. Patrick Drew
Dynamics, stability, and control of human walking

Above: Experimental measurements of stepping behavior used to develop models to test theories of motor regulation and design interventions to mitigate fall risk

PIs: Drs. Cusumano & Dingwell
Theory of Nanoscale Plasmonic Materials

Top: Examples of modeling of nanoscale antennas (near-field tip, nanotube polariton).

Bottom: Theoretical vs. experimental maps of twisted graphene plasmonic disk.

PI: Dr. Slava Rotkin
Nanophotonics characterization of 2D- & Bio-materials

Above: Maps taken by scattering Scanning Near-field Optical Microscope on different materials, revealing material properties with sub-diffractional resolution

PI: Dr. Slava Rotkin
Materials for MRI and 5G

**MATERIALS**
Properties and Processes

- Permittivity
- Permeability
- Conductivity

**ELECTROMAGNETIC SIMULATION**
FDTD, MoM, FEM

- Integration
- Tractable Fabrication

**DEVICES**
Antennas, Filters, MRI

- HDC Material
- High Field Bore
- RF coil

Dielectric Helmet with High Permittivity Material

Simulated and measured electromagnetic fields in human head at MRI frequency

5G antenna structures with high permittivity materials

PI: Dr. Mike Lanagan

Department of Engineering Science and Mechanics
Biomembranes and membrane-mediated processes

Above: Coarse-grained modeling of: vesicle shape transition pathways; two-component vesicle phase dynamics; Drug or DNA delivery via nanoparticles

PI: Dr. Sulin Zhang
Doing optics at the exceptional points

Above: From optical sensing to control of light propagation

PI: Dr. Sahin Ozdemir
### Additive manufacturing of metals for energy applications

#### Rethinking Materials for the Energy Sector Through Additive Manufacturing

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Additive manufacturing of metals for energy applications

Above: Solutions for the energy sector through additive manufacturing and repairs of corrosion resistant, high strength, and creep resistant materials.

PI: Dr. Todd A. Palmer
Theory-driven functional materials synthesis and fabrication to produce next generation materials by merging synthetic biology and materials science.

Above: From self-assembly to molecular composites

PI: Dr. Melik Demirel
Mathematical models of brain-on-a-chip and brain’s non-locality

Above: Design of a brain-on-a-chip, mechanotransduction and non-locality

PI: Dr. Corina Drapaca
Environmental Degradation

Above: Developing new, corrosion resistant alloys for varied applications
Sensing and measuring corrosion in hard to access areas

Assessing corrosion response of AM metals

PI: Drs. Sikora & Shaw