Controls

Dr. Mark Bedillion

- Distributed Manipulation
  - Many relatively simple actuators cooperatively produce complex motion
  - Distributed sensing, distributed assembly, and multi-wheeled vehicles
- Data Storage
  - Control for dual-stage actuators, bias compensation, and skew compensation
- Manufacturing Control
  - Chatter control and learning control to reduce build iterations
- Robotics
  - Localization, formation control, and path planning for air/ground robotic teams

Dr. Dan Dolan (CAMP)

Dr. Ali Heydari

- Control of Hybrid and Switching Systems
- Decentralized Control of Multi-agent or Large-scale Systems
- Control of Cyber-physical Systems
- Optimal Control
  - Problems with state and control constraints
  - Problems with fixed final time
- Guidance, Navigation, and Control of Aerospace Systems
- Path Planning
- Nonlinear Systems

Dr. Shaobo Huang

Dr. Vojislav Kalanovic

Dr. Umesh Korde

- Sustainable Energy: marine hydrokinetic energy with a focus on ocean wave energy conversion (engineering design, analytical modeling, laboratory testing) , time-domain control for cost effective operation (linear and nonlinear systems)

Thermal Science

Dr. Duane Abata

- Transient and steady state combustion
- Internal combustion engines
- Alternative biofuels
- Fuel delivery and fuel sprays
- High pressure ignition

Dr. Michael Langerman

- Radiometric analysis of laser additive manufacturing applications for process/part diagnosis and qualification

Dr. Bamdad Lessani

Dr. Khosro Shahbazi

- Biomedical engineering
    - Shock wave lithotripsy for breaking kidney stones
    - Cancer drug delivery using micro-bubbles and ultrasound waves

Solid Mechanics

Dr. Jason Ash

- Interfacial Mechanics of Composite Materials
    - Interfacial bond strength measurement between fiber and matrix
    - Designed axisymmetric test fixture for microbond experimentation
    - Utilized FEA to perform stress based failure analysis
    - Potential to predict interfacial failure of other systems
- Biaxial Testing of Composite Materials
    - Composite material failure strength characterization
    - Validation of results with strain gages and FEA
    - Failure data needed for structural design/analysis

Dr. Cassandra Degen

- Design, fabrication, and analysis of multifunctional structures and materials
    - Manufacturing of structures with multifunctional potential
        - Inspired by 3D panels made at Pacific Northwest National Laboratory
        - Incorporation of polymers could enhance functionality
    - Coupling mechanical stimuli with varied automatic responses
        - Transfer of mechanochemistry knowledge
        - Elicit responses such as optical, chemical, magnetic, energetic, etc.

Dr. Marius Ellingsen

- Mechanical Behavior of Materials and Material Systems
    - Experimental Solid Mechanics
        - Bi-material systems (layered materials)
        - Cold spray deposited materials
        - Layered polymer composites
        - Fracture Mechanics
        - Optical stress-strain measurement methods:
            - Photoelasticity
            - Automated speckle pattern analysis
        - Electromechanical strain measurement methods
        - Material Fatigue Characterization
            - Rotating beam fatigue testing
            - Axial fatigue testing
        - Material Fracture Characterization
            - Critical stress intensity factor determination (KIC)
            - Crack growth behavior (da/dN)

Dr. Lidvin Kjerengtroen

Dr. Karim Muci

- Computational Mechanics
- Solid Mechanics
- Biomechanics

Dr. Albert Romkes

Computational and applied mechanics and mathematics with an emphasis on: (multi-scale) modeling of heterogeneous media and multiphysics/interaction processes, numerical analysis of partial differential equations arising in continuum mechanics applications, development of finite element type methods of approximation, estimation of approximation and modeling error, and development of strategies for mesh-adaptive finite element processes.

Dr. Christian Widener (Director, Arbegast Materials Processing Lab [AMP])

- Friction Stir Welding
- Laser Powder Deposition
- Cold Spray
- Direct-Write

Experimental and Computational Mechanics Laboratory (ECML)

- Computer Simulations
  - Available Hardware
    - Two computer servers
    - Twenty-four computer workstations
  - Available Software:
    - ABAQUS, AUTODYN, FLUENT, others
    - Xcitex-ProAnalyst and GOM-ARAMIS
- Key Experimental Equipment
  - Two Photron SA1.1 monochrome and one Photron SA4 color high speed cameras.
  - Data acquisition systems (up to 2.5 Ms/s/ch).
  - Pressure sensors and accelerometers.
  - Instrumented human head surrogates.
- Small-Scale Ballistics Laboratory
  - Air rifles in 0.177-in, 0.22-in, 9-mm, 0.45-in, and 0.50-in calibers.
  - Maximum speeds ranging from 700 ft/s for 0.50-in caliber, 250-grain projectiles, to 1,350 ft/s for 0.177-in caliber, 5.1-grain projectiles.
  - 20 ft x 13 ft x 9 ft armored testing enclosure.

    - Surrogate extremities made of soft tissue surrogates (ballistic gelatin, PERMA-GEL).
    - Area for bacteria distribution studies
- Small-Scale Compressed Gas Blast Testing
    - 2-in and 4-in diameter open ended shock tubes with bursting pressures up to 800 psig.
    - Vertical impulse measuring module (VIMM).
    - Schlieren imaging with 8-in and 16.25-in parabolic mirrors to visualize shock waves and fluid flow.
    - Testing enclosure with clear sides for viewing.
- Sample Projects
    - Bacteria distribution in surrogate ballistic wounds
    - Development of extremity body armor
    - Blast effects on helmet-head systems
    - Comparison of blast mitigation characteristics of different materials
    - Simulation of shallow buried blasts in sand
    - Helmet for search and rescue (SAR) teams