Mechanical Engineering

Introduction

UMBC's Department of Mechanical Engineering offers undergraduate and graduate programs, from bachelor's to doctoral degrees. Research is focused in biomechanics, design, manufacturing and systems, mechanics and materials and thermofluid mechanics.

Corporations and government agencies – such as the U.S. Army, Black & Decker, Chrysler, Ford, General Motors, IBM, Motorola, Smith International, and the National Security Agency – consistently recruit UMBC mechanical engineering graduates.

Programs

Dr. Panos G. Charalambides, Chair
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Faculty: 15

Faculty Areas of Expertise:

Design and Manufacturing

- Flexible manufacturing
- Mechatronics
- Cutting tool design
- Robotics
- Vibration and automatic control
- Design for manufacture and/or robust design

Thermal Fluids

- Heat and mass transfer
- Hydrodynamic stability
- Computational heat transfer and fluid dynamics

Solid Mechanics and Materials

- Plasticity
- Impact dynamics
- Fracture and computational mechanics
- Mechanics of composites and layered materials
- Finite elements
- Engineering education

Biomechanics

- Computational bio-fluid mechanics
- Mechanical analysis of living structures
- Implantable biomaterials
- Mechanics of hard tissue and restorative dentistry
- Animal lameness
- Bone mechanics

Recent Collaborations

Dr. Weidong Zhu with National Science Foundation
Develop novel experimental and theoretical techniques to analyze and control the vibration of elevator cables with variable length.

Dr. Appa Anjanappa with Maryland Industrial Partnerships (MIPS) / Scientific Products & Systems, LLC
Develop a compact, low-volume, cost-effective, highly reliable and automated Precision Dispensing System (PDS).

Dr. Panos Charalambides with Technology Assessment and Transfer and Ceramic Composites Inc. through a U.S. Air-Force PRDA grant
Design a new generation of ceramic matrix woven grids for ion propulsion applications.

Dr. Tony Farquhar with Northrop-Grumman, Electronic Sensors & Systems Sector
Predict the performance and reliability of a Micro-Electrical-Mechanical-Systems vacuum pump suitable for use in a miniature bio-gas sampling machine.

Dr. Uri Tasch with USDA Competitive Grant Program
Determine the sensitivity and selectivity of a novel system for identifying lameness in dairy cattle

Dr. Liang Zhu with American Heart Association
Develope a heat transfer model to study the transient and steady state temperature distribution during head surface cooling for head injury patients.

Dr. Akhtar Khan with Pacific Northwest National Laboratory
Investigate the effects of strain rate on the plastic deformation behavior of aluminum weld.

Dr. Chuck Eggleton with Alliance Pharmaceuticals
Determine the effects of adding artificial blood to the circulatory system on blood viscosity.

Dr. Panos Charalambides with National Institute of Standards and Technology (NIST)
Develop new and innovative algorithms capable of using 2-D images extracted from complex material microstructures to reconstruct 3-D finite element models for thermomechanical analysis. The project outcomes could also benefit biomedical and homeland security technologies.

Dr. Appa Anjanappa with Black & Decker
Developed novel masonary and wood drill bits.

Dr. Akhtar Khan with Army Research Office
Investigate the dynamic multiaxial loading response and constitutive/damage modeling of titanium and titanium alloys.

Innovator of the Year

Dr. Uri Tasch has developed a statistical model that captures the clinical locomotion scores veterinarians assign to dairy cows. The statistical model inputs are Limb Movement Variables measured by a patent pending Reaction Force Detection (RFD) system. By determining the sensitivity and selectivity of the model one can predict how well the entire RFD system will perform. This research can make a difference for the nation's livestock farmers, saving them millions of dollars a year in reduced yields and veterinary bills.

Artificial Joints

Dr. Tim Topoleski is at the cutting edge of improving next-generation artificial joint materials, with funding from the Arthritis Foundation. The goal of Dr. Topoleski's research is to reduce failures of artificial joints by first understanding how those joints fail. This project includes collaborations with Anderson Materials Evaluation, the Anderson Orthopedic Research Institute and Xylon Corporation.

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Plasticity Symposium

Dr. Akhtar Khan co-chairs the Plasticity Symposium series, the prime forum for plasticity research dissemination with more than 250 distinguished scientists participating from around the world. Topics include plastic and viscoplastic behaviors of single crystals and polycrystalline metals, nanocrystalline metals, thin films, biomaterials, ceramics, ice, rocks and soils, composite materials and polymers, plasticity aspects of damage, failure and fracture mechanics. Dr. Khan is also Editor-in-Chief of *International Journal of Plasticity*.

Next Generation of Engineers

Dr. Anne Spence is developing three compact disc curriculum kits, each targets a different aspect of engineering (chemical, electrical, and mechanical) in a project that can be used in middle and high school algebra classes (sponsored by the National Science Foundation).

Mission to Pluto

Dr. Panos Charalambides is leading a UMBC team working with scientists from industry, government and academia to design C-C woven grids for ion propulsion applications. The ion engines will be used for a mission to Pluto, which is expected to operate continuously over a period of 10 years.

At the Cutting Edge

Dr. Dwayne Arola provided experimental verification that a new auxiliary fuel tank design proposed by Decrane Aircraft warranted certification from the Federal Aviation Administration (FAA) for infinite design life.

About UMBC

The University is a thriving center for research and development and technology commercialization. Campus research grants and training contracts have topped $85.5 million, up from $10 million nine years ago. Patent applications by UMBC researchers have more than quadrupled in three years and more than 125 University-developed technologies are available for licensing.

Adjacent to the campus, the techcenter@UMBC is a magnet for high-technology business development and offers a dynamic, fully-equipped facility for start-up and emerging companies. Its specialized environment promotes strategic alliances among tenants and connections with the UMBC faculty, students and companies in the region. UMBC is a member of Internet 2 with high-speed Internet connectivity.

Research Facilities

The Mechanical Engineering Department, located in the $30 million Engineering and Computer Schience building with over 12,000 square feet of departmental laboratories, has extensive facilities for research including:

- Inelastic Impact Dynamics Laboratory
- Advanced Manufacturing Laboratory
- Mechatronics Laboratory
- Biomaterials Research Laboratory
- Orthopedic Biomechanics and Implantable Materials Laboratory
- Cutting Tool Research and Development Laboratory
- Computational Fracture Mechanics and Composites Laboratory
- Robotics and Animal Well-Being Laboratory
- Dynamic Systems and Vibrations Laboratory

Department research is supported by state-of-the art equipment, including:

- 2 Scorob-5 desktop manipulators
- 5000 axial, 20,000in-lb torsional materials testing machine
- Custom wear testing equipment
- White light interference surface profilometer
- 2 small (1,000 lb axial) load frames
- Atomic absorption spectrometer
- 12-channel spectrum analyzer
- dSPACE 1103 DSP controller
- Monsanto Tensometer 2.2 kip load frame with hot test environmental chamber
- Chevalier vertical knee milling machine
- Sun Ultra 450 server
- Sparc workstations
- SMZ800 Nikon Dissection Microscope
- Transonic Flow Meter
- National Instruments dual processor RT (real time) data acquisition and control system
- Olympus & Zeiss Axioplan optical microscopy systems

Contact Information

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