Department of Mechanical, Materials and Aerospace Engineering

Degrees Offered

- Masters of Science, Aerospace Engineering (M.S.A.E.)
- Masters of Science, Mechanical Engineering (M.S.M.E.)
- Masters of Science, Materials Science and Engineering (M.S.M.S.E)
- Doctor of Philosophy, Aerospace Engineering (Ph.D.)
- Doctor of Philosophy, Mechanical Engineering (Ph.D.)
- Doctor of Philosophy, Materials Science and Engineering (Ph.D.)
- Accelerated Bachelor's/Master's Program in Aerospace Engineering
- Accelerated Bachelor's/Master's Program in Mechanical Engineering

Departmental Overview

FACULTY

Faculty members in the Mechanical, Materials, and Aerospace Engineering (MMAE) department have extensive research, industrial, and teaching experience and have published widely. Their combined experience helps them assist students in selecting relevant courses and research topics to meet their educational goals. The Department has excellent laboratory facilities in the Engineering Sciences Building, the Engineering Research Building, and the new Advanced Engineering Research Building to provide support for both instructional and research activities. The Department has several special purpose laboratories located nearby, which include the Engine Research Center, the Advanced Combustion Laboratory, and the wind tunnel laboratory in the hangar at the Morgantown Municipal Airport (Hart Field). Funded research allows the Department to maintain up-to-date facilities that include modern instrumentation and computing and lab equipment, including simulation and computer-controlled data acquisition systems.

Areas of Research

Graduate courses in the MMAE department are organized under six academic areas: fluids and aerodynamics, solid mechanics and structures, design and controls, thermal sciences, bioengineering, and materials science and engineering. Students who are pursuing an advanced degree in either mechanical or aerospace engineering and in materials science and engineering may perform their thesis or dissertation research and specialize in any one of these areas.

FLUID MECHANICS AND AERODYNAMICS

A variety of courses and facilities support graduate research in aerodynamics and fluid mechanics. Laboratories are located in college buildings and remote sites. Flow facilities include instrumented subsonic and supersonic wind tunnels, and several flow loops mainly used for research in gas-solid and density stratified flows. Available instrumentation includes eight channels of hot wire/film anemometry, two single-component and one three-component, laser Doppler velocimeter (LDV) systems, and a particle image velocimeter (PIV) system. The department owns two flight simulation facilities, one that simulates translational and rotational motion in six degrees of freedom, and the other that relies on D-six software to provide "joystick only" flight simulation. Furthermore, the department built and operates different types of Unmanned Airborne Vehicles (UAV's), as well as experimental aircraft and airborne systems that are housed in a hangar owned by the department at the Hart Field municipal airport in Morgantown. A significant portion of the current activity involves numerical solutions to flow problems and is supported by a computing facility dedicated to graduate research.

Although the faculty background and interests in the areas of aerodynamics and fluid mechanics are broad, recent research has been concentrated on applications of computational fluid dynamics (CFD) to investigate a wide variety of problems in fuel cell technology, fixed wing and rotorcraft aerodynamics, bioengineering, and combustion. The department's faculty have accumulated extensive research experience in multiphase and density-stratified flows, low-speed aerodynamics, shock phenomena in two-phase systems, flow in microgravity, boundary layer control, and high-speed aerodynamics. Previous and current research areas include topics such as fluidized bed combustion, aerosol sampling, flow metering, flow distribution systems, numerical solutions to gas-solid flows, and fluid-particle turbulence interactions, including deposition on solid surfaces. The low-speed aerodynamics work is related to the design of vertical axis wind turbines and STOL airfoils.

SOLID MECHANICS AND DESIGN

The solid mechanics and design area encompasses the theoretical, numerical, and experimental study of solid bodies, from concentration on local behavior of deformable bodies to the global response of structural elements. Hence, students may explore the mechanical behavior of materials in the neighborhood of micro-scale defects such as cracks, or investigate the behavior of large-scale bodies such as aerospace structures.

The faculty members specialized in this area carry out basic and applied research using state-of-the-art computational and experimental techniques. The areas of research include advanced metal alloys and composite materials, lightweight structures, safety and durability enhancements, real time monitoring and diagnosis of structural systems, aero elasticity, fracture mechanics, nonlinear dynamics and vibrations, biomechanics; and computational methods and experimental techniques, including optical and ultrasound methods. Furthermore, in cooperation with the Wadsworth Department of Civil and Environmental Engineering, MMAE graduate students may pursue studies related to civil engineering. A large array of research facilities includes laboratories (materials, structures, vibrations, photo mechanics, biomechanics, fracture mechanics), computers (work stations, personal computers, computer-aided engineering), and mechanical and electronic shops.

DYNAMICS AND CONTROLS

The dynamics and controls area offers instructional and research opportunities for students who seek to attain the expertise required to control the behavior of an engineering system in a dynamic environment. Instructional offerings equip the students with a foundation for developing prototype systems and for improving the performance of existing systems. Selected examples of research areas include flight simulation and controls, automatic controls, advanced instrumentation, microprocessor applications and non-destructive testing; elastodynamic analysis, computer-aided design (CAD); and modeling, design, and analysis of energy management systems.

THERMAL SCIENCES AND SYSTEMS

The thermal sciences and systems area encompasses the fields of thermodynamics, combustion, heat transfer, and power and energy systems. Graduate course offerings cover a wide range of topics in this area with applications to both aerospace and mechanical engineering problems. Recent research efforts include topics such as alternative fuels testing, internal combustion engine performance and emissions, fuel cell technology, heat transfer, numerical analysis of thermal systems, the analysis of fluidized bed combustion, energy analysis of buildings, oscillating jet combustion, deposition on turbine blades, and reactor design.

Research facilities include a state-of-the-art engine research laboratory, three transportable emissions research laboratories, thermal analyzers, recording thermocouple data-acquisition systems, high-altitude simulation chamber for ablation and wear studies, a fluidized bed combustion laboratory, an electrically-heated, natural convection water facility, Schlieren systems for flows with varying density, and a water reservoir for thermal stratification studies.

BIOENGINEERING

Areas of research specialization related to bioengineering include ultrasound technology for imaging of body tissues and organs, respiratory and diseased tissue mechanics, orthopedic mechanics, bone growth and fracture, and the application to rehabilitation of computer-aided design and microprocessor-based instrumentation. Research facilities include a state-of-the-art ultrasound imaging laboratory, an aerosol inhalation exposure system, laser-based holographic and moiré interferometric equipment, a lung acoustic impedance measurement system; and modern orthopedic, rehabilitation, and computer research laboratories.

MATERIALS SCIENCE AND ENGINEERING

The material science and engineering area allows for the study of processing, structure, and properties of materials for structural, functional, and device applications. Areas of research emphasized within this area include advanced microscopy, composite materials, materials for fuel cells, smart materials, super alloys, facilities incorporating electron microscopy, scanning probe microscopy, electro-chemical characterization, thermal analysis, and mechanical testing facilities.

FACULTY CHAIR

Jason Gross - Ph.D. (West Virginia University)
 Unmanned Aerial Vehicles, Avionic Systems, Flight Testing

PROFESSORS

- Xueyan Song Ph.D. (Zhejiang University, China) Materials Science, Electron Microscopy
- V'yacheslav Akkerman Ph.D. (Umeå University, Sweden) Turbulent Combustion, Flame Tribalization
- Ever J. Barbero Ph.D. (Virginia Polytechnic Institute and State University) Materials, Experimental and Computational Mechanics
- Wade W. Huebsch Ph.D. (Iowa State University) Fluid Mechanics, CFD, Numerical Methods
- Bruce S. Kang Ph.D. (University of Washington) Experimental Mechanics, Advanced Materials
- John M. Kuhlman Ph.D. (Case Western Reserve University) Fluid Mechanics
- Hailin Li Ph.D. (University of Calgary, Canada)
 Combustion, Emissions, Fuel Efficiency of Vehicles and IC Engines

- Xingbo Liu Ph.D. (University of Science and Technology of China, Beijing) Materials Science
- Pedro J. Mago Ph.D. (University of Florida) Heat and power systems, building energy simulation, and waste heat recovery technologies
- Victor H. Mucino Dr.Eng., P.E. (University of Wisconsin-Milwaukee) Mechanical Engineering Design, CAD, Finite Element Analysis
- Marcello R. Napolitano Ph.D. (Oklahoma State University) Aircraft Stability and Control, Feedback Control, Unmanned Airborne Vehicles (UAVs)
- Mario Perhinschi Ph. D. (University of Bucharest, Romania) Flight Modeling and Simulation
- Songgang Qiu Ph. D.(University of Minnesota) Thermodynamics, Heat Transfer
- Edward M. Sabolsky Ph.D. (The Pennsylvania State University) Materials, Ceramic Science
- Nithi T. Sivaneri Ph.D. (Stanford University) Structural Mechanics, Composite Materials, FEM, Numerical Methods

ASSOCIATE PROFESSORS

- Omid Askari Ph.D. (Northeastern University) Engines, GasTurbines, Alternate Fuels
- Cosmin E. Dumitrescu Ph.D. (University of Alabama) Combustion, Alternate Fuels, IC Engines
- Jason N. Gross Ph.D. (West Virginia University) Unmanned Aerial Vehicles, Avionic Systems, Flight Testing
- Yu Gu Ph.D. (West Virginia University) Robotic Systems, Sensor Fusion
- Derek Johnson Ph.D. P. E. (West Virginia University) Alternative Fuels, Engines and Emissions
- David S. Mebane Ph.D. (Georgia Institute of Technology)
 Fuel Cells, Mutli Scale Simulation of Chemical and Electrochemical Systems
- Osama Mukdadi Ph.D. (University of Colorado) Bioengineering, Acoustics, Solid Mecanics and Materials
- Terence D. Musho Ph.D. P.E. (Vanderbilt University) Nanoscale Thermal and Electrical Transport, Direct Energy Conversion
- Andrew C. Nix Ph.D. (Virginia Polytechnic Institute and State University) Turbines, Engines and Emissions
- Guilherme Augusto Silva Pereira Ph.D. (Federal University of Minas Gerais) Field Robotics, Autonomous Vehicles
- Loren Rieth Ph.D. (University of Florida) Microelectrode Implants, Electrical & Neural Prosthesis
- Konstantinos Sierros Ph.D. (University of Birmingham, U. K.)
 Flexible Optoelectronic Devices, Tribology, Materials for Renewable Energy
- Arvind Thiruvengadam Ph.D. (West Virginia University) Emissions of Heavy-Duty Internal Combustion Engines
- Gregory J. Thompson Ph.D. (West Virginia University) Thermodynamics, Machine Design
- W. Scott Wayne Ph.D. (West Virginia University) Machine Design, Alternative Fuels

ASSISTANT PROFESSORS

- Xi Yu Ph.D. (Boston University) Robotics
- Piyush M. Mehta Ph.D. (University of Kansas) Astrodynamics, Space Situational Awareness
- Nicholas Szczecinski Ph.D. (Case Western Reserve University) Robotics

TEACHING ASSOCIATE PROFESSOR

 Patrick H. Browning - Ph.D. (West Virginia University) Aerodynamics, Aircraft Design

TEACHING ASSISTANT PROFESSORS

- Christopher Griffin Ph.D. (West Virginia University) Aerodynamics, Fluid Mechanics
- Andrew P. Rhodes Ph.D. (West Virginia University) Aerospace Dynamics and Propulsion
- Emily Spayde Ph.D. (Mississippi State University)
 Engineering education, energy sustainability and organic Rankine cycles

RESEARCH ASSOCIATE PROFESSORS

- Yun Chen Ph.D. (Universidade Tecnica de Lisboa) Material Science, Metal Hydrides, Cathode Material Development
- Eduardo Sosa Ph. D. (University of Puerto Rico) Thin Wall Structures

RESEARCH ASSISTANT PROFESSORS

- Ali Baheri (University of North Carolina at Charlotte) Machine Learning, Autonomous Driving
- Shanshan Hu Ph.D. (West Virginia University) high temperature corrosion, molten salt, anti-corrosion coating and electrophoretic deposition
- Wei Li Ph.D. (Graduate University of Chinese Academy of Sciences)

VISITING AND ADJUNCT PROFESSORS

- Alberto Ayala Ph.D. (University of California, Davis) Energy, Engine Emissions
- Dureid Azzouz Ph.D. (University of Southampton, U.K.) Fluid Mechanics
- Albert Boretti Ph.D. (University of Florence, Italy)
 Innovative Combustion Engines
- Mark Bright Ph.D. (West Virginia University) Materials Engineering, Pyrotech Inc.
- Darran Cairns Ph.D. (University of Birmingham, U.K.) Materials Science
- Weigiang Ding Ph.D. (Northwestern University) Nanostructures
- Renguang Dong Ph.D. (Concordia University) Biomechanics, Human Vibrations, NIOSH
- Mridul Gautam Ph.D. (West Virginia University)
 Alternate Fuels, Engine and Emissions, VP for Research UNR
- Luis A. Godoy Ph.D. (University of London, U.K.) Structural Stability
- Frank E. Goodwin Sc.D. (Massachusetts Institute of Technology) Materials Engineering, ILZRO
- Valeriya Gritsenko Ph.D. (University of Alberta, Canada) Neuroscience
- Huang Guo Ph.D. (West Virginia University) Electro-Chemistry, Materials Science, Mechanical Engineering
- Srinkath Gururajan Ph.D. (West Virginia University) Small Unmanned Aerial Vehicle Systems
- Nabil S. Hakim Ph.D. (Wayne State University) Alternative Fuels Engines and Emissions
- Yiqun Huang Ph.D. (University of Texas, Austin) Engine Emissions Control
- Paul E. King Ph.D. (Oregon State University)

Materials Engineering, NETL

- George Kiriakidis Ph.D. (Salford University, U.K.) Physics, Mechanics
- Stephen Kukureka Ph.D. (University of Birmingham, U.K.) Materials Science
- Andrew D. Lowery Ph.D. (West Virginia University) Control Systems
- Alejandro Lozano-Guzman Ph.D. (University of New Castle Upon Tyne, U.K.) Dynamic Systems (CICATA-IPN Mexico)
- Ayyakkannu Manivannan Ph.D. (The University of Tokyo, Japan) Materials Chemistry Characterization
- Eugene A. McKenzie Ph.D. (West Virginia University) Mechanical Engineering Design, NIOSH
- Chris Menchini Ph.D. (West Virginia University) Computational Fluid Dynamics, Fire Modeling
- Vincenzo Mulone Ph.D. (University of Rome, Tor Vergata) Engine Emissions, Fluid Mechanics
- John Nuzkowski Ph.D. (West Virginia University) Alternative Fuels and Engine Emissions, UNF
- Ming Pei M.D., Ph.D. (Beijing Medical University, China) Tissue Engineering, HSC-WVU
- Alber Alfonse Sadek Ph.D. (Osaka University, Japan) Alloys
- Brad Senor Ph.D. (West Virginia University) Control Systems
- Benjamin Shade Ph.D. (West Virginia University) Engine Emissions, IAV Automotive
- Alberto Traverso Ph.D. (University of Genoa, Italy) Energy Systems and Control, DIMSET - Italy
- Nathan Weiland Ph.D. (Georgia Institute of Technology) Energy Systems, Experimental, Computational, Theoretical Methods
- Jay Wilhelm Ph.D. (West Virginia UNiversity)
 Unmanned Aerial Vehicles, Wind Turbine Modeling
- Gergis William Ph.D. (West Virginia University) Structural Engineering
- Steven Woodruff Ph.D. (University of Michigan) Combustion Optical Phenomena
- David Wyrick Ph.D. (University of Missouri-Rolla) Engineering Management, Engineering Education, SME's
- Sergiy Yakovenko Ph.D. (University of Alberta, Canada) Neuroscience
- Kirk Yerkes Ph.D. (University of Dayton) Energy Optimized Aircraft

PROFESSORS EMERITI

- Richard A. Bajura Ph.D. (University of Notre Dame)
- Larry Banta Ph.D. (Georgia Institute of Technology)
- Ismail Celik Ph.D. (University of Iowa)
- Nigel N. Clark Ph.D. (University of Natal, South Africa)
- Eric Johnson Ph.D. (University of Wisconsin-Madison)
- John M. Kuhlman Ph.D. (Case Western Reserve University)
- John Loth Ph.D. (University of Toronto, Canada)
- Ken Means Ph.D (West Virginia University)
- Gary Morris Ph.D. (West Virginia University)
- Michael G. Palmer Ph.D. (West Virginia University)
- Samir N. Shoukry Ph.D. (Aston University, Birmingham, U.K.)

- John E. Sneckenberger Ph.D. (West Virginia University)
- Wallace S. Venable Ed.D. (West Virginia University)
- Richard E. Walters Ph.D. (West Virginia University)