Proposed Honors Project for '09-'10

Do not be intimidated by this list of projects! Talk to the faculty members about projects that you think you might be interested in. Furthermore, do not worry just yet about writing a proposal for one of the topics listed below. In most cases, you will be given significant assistance and feedback in writing the proposal. This list of projects is not exhaustive. If you are interested in a particular research area or working with a particular professor, feel free to inquire on your own and "carve" out your own project. Note that you can work with any faculty member at OSU who is allowed to advise graduate students.

Also note that some of the projects below involve non-ME faculty involved in multidisciplinary research and that have active collaboration with ME faculty members.

Finally, the projects are *** **loosely** *** organized in a few categories. Many projects do not fit neatly in a category, so explore the whole list so you do not overlook topics of potential interest.

Once you have contacted relevant faculty member(s) and selected (in partnership with an adviser) a specific topic for your undergraduate research, you must develop a short 5-page **Honors research proposal which is to be turned in the College of Engineering by the 2nd Friday of the Spring quarter**. If any questions concerning the logistics, contact Professor Guezennec at Guezennec.1@osu.edu.

Applied Mechanics, Design, Manufacturing, and Tribology Topics

1. **Nanoscale Measurements using Atomic Force Microscopy for Nanotechnology**, System/Design, Prof. B. Bhushan, Bhushan.2@osu.edu, 2-0651, Experimental.
2. **Experimental Study of Ionic Liquids,** System/Design, Prof. B. Bhushan, Bhushan.2@osu.edu, 2-0651, Experimental.
3. **Fabrication of Nanostructures with Superhydrophobic Properties,** System/Design, Prof. B. Bhushan, Bhushan.2@osu.edu, 2-0651, Experimental.
4. **Adhesion Analysis of Hierarchical Morphology on Nanoscale,** Mechanics/Design, Prof. B. Bhushan, Bhushan.2@osu.edu, 2-0651, Modeling.
5. **Wetting Analysis of Superhydrophobic Surfaces,** Mechanics/Design, Prof. B. Bhushan, Bhushan.2@osu.edu, 2-0651, Modeling.
6. **Development and Characterization of Materials for High Temperature (Solid Oxide) Fuel Cells**. Mechanics of Materials, Prof. M. Walter, walter.80@osu.edu, 2-6081, experimental.
7. **Understanding Fatigue Initiation in Carbon-Carbon Aircraft Brake Material**. Mechanics of Materials, Prof. M. Walter, walter.80@osu.edu, 2-6081, experimental.
8. **Developing *Image-Based Computational Models* of microstructures for Metals, Composites, and Biological Materials using CAD and statistical tools**, Prof. S. Ghosh, ghosh.5@osu.edu, Computational with some imaging experiments.
9. **Molecular Dynamics modeling of thin films in Nanotechnology,** Prof. S. Ghosh, ghosh.5@osu.edu, Computational.
10. **Synthesis Methods for the Creation of Carbon Nanotube Fibers**, Design and Manufacturing, Prof. A. Luscher, luscher.3@osu.edu, 2-4474, Experimental.

11. **Creation of a Device to Measure Human Arm Mass and Stiffness**, Design/ Ergonomics, Prof. A. Luscher, luscher.3@osu.edu, 2-4474, Design and Prototyping.
12. **Creation of a Carbon Composite Measurement Rail with Near Zero COF for Composite Assembly**, Design and Manufacturing, Prof. A. Luscher, luscher.3@osu.edu, 2-4474, Design and Prototyping.
13. **Measurement of pediatric bone properties,** Injury Biomechanics**,** Prof. John Bolte, bolte.6@osu.edu, 688-4015, experimental.
14. **Effects of Crystallization on the Mechanical Behavior of Polyesters**, Mechanical Behavior of Materials, Prof. R. Dupaix, dupaix.1@osu.edu, 2-8404, experimental.
14**. Mechanical Characterization of Polymers**, Mechanical Behavior of Materials, Prof. R. Dupaix, dupaix.1@osu.edu, 2-8404, experimental.
17. **Micro-hot Embossing of Polymers**, Manufacturing, Prof. R. Dupaix, dupaix.1@osu.edu, 2-8404, computational or experimental.
18. **Mechanical Behavior of Electrospun Polycaprolactone for Tissue Engineering**, Mechanics of bio-materials, Prof. R. Dupaix, dupaix.1@osu.edu, 2-8404, experimental.
18. **Mechanical behavior of soft abdominal organs**. Mechanics of bio-materials, Prof. R. Dupaix,dupaix.1@osu.edu, 2-8404, experimental.
19. **Various Industrial Design and Manufacturing Projects,** Professor T. Altan, altan.1@osu.edu, 2-5063,experimental and numerical, Please visit www.ercnsm.org and www.cpforming.org
20. **Durability of Dental Restorations**, Materials, Mechanics, Design, Prof. N. Katsube, katsube.1@osu.edu, 2-0971, computational, analytical and experimental.
21. **Mechanics of Cartilage**, Biomechanics, Materials, Design, Prof. N. Katsube, katsube.1@osu.edu, 2-0971, computational.
22. **Characterization of mechanical properties for breast simulating phantoms**, Biomedical, Prof. Ronald Xu, xu.202@osu.edu, 8-3635, experimental.
23. **Control of Walking in Patients with Neuromuscular Diseases,** Biomechanics, Prof. R. Siston, siston.1@osu.edu, 7-2721, experimental.
24. **How Changing Posture and the Environment Affects Locomotion,** Biomechanics, Prof. R. Siston, siston.1@osu.edu, 7-2721, simulation.
25. **Determining the Rotational Axes of the Knee from Kinematic Screw Theory,** Biomechanics and Kinematics, Prof. R. Siston, siston.1@osu.edu, 7-2721, experimental and theoretical.
26. **Microfluidic Chip for Cell Encapsulation**, Biomedical Microdevice, Prof. Y. Zhao, zhao.178@osu.edu, 7-7424, analytical and experimental
27. **Double-Sided Micromolding**, Biomedical Microdevice, Prof. Y. Zhao, zhao.178@osu.edu, 7-7424, experimental.
28. **In-line Pressure Sensor for Lab-on-Chip Applications,** Biomedical Microsystems, Prof. Y. Zhao, zhao.178@osu.edu, 7-7424, analytical and experimental.
29. **Visualizing the Changes of Tissue Mechanical Behaviors under Massage Therapy,** Biomedical Devices, Prof. Y. Zhao, zhao.178@osu.edu, 7-7424, programming and experimental.
30. **Evaluating the Massage Effectiveness on Small Animals,** Biomedical Devices, Prof. Y. Zhao, zhao.178@osu.edu, 7-7424, experimental.
31. **All-in-One Tactile Microsensor for Simultaneous Measurement of Compressive and Shear Stress.** Biomedical Microdevice, Prof. Y. Zhao, zhao.178@osu.edu, 7-7424, analytical and experimental.
32. **Mechanical Collapse of Polymeric Microstructures and its Application in Biosensors,** mechanics, Prof. Y. Zhao, zhao.178@osu.edu, 7-7424, analytical and experimental.

33. **Development of a Perfusion Microchip for Trabecular Meshwork Cells**, Biomedical Microdevice, Prof. Y. Zhao, zhao.178@osu.edu, 7-7424, experimental.

Dynamics, Control, and Smart Materials Topics

1. **Are Some Toys Very Noisy?** Acoustics, Prof. R. Singh, singh.3@osu.edu, 2-9044, experimental.
2. **Do The Active Headsets Cancel Certain Noise Signals?** Acoustics & Vibration, Prof. R. Singh, singh.3@osu.edu, 2-9044, experimental and computational.
3. **Design For Reduced Brake Judder (Sponsored By Honda R&D),** System Dynamics & Vibration, Prof. R. Singh, singh.3@osu.edu, 2-9044, design, experimental and computational.
4. **Effect Of Surface Finish On Noise From Machine Elements**, Acoustics & Vibration, Prof. R. Singh, singh.3@osu.edu, 2–9044, experimental and computational
5. **Helicopter Gear Noise Control (Smart Vehicle Concepts Center)**, Acoustics & Vibration, Prof. R. Singh, singh.3@osu.edu, 2–9044, experimental and computational.
6. **Interrelation Between 'Green' Buildings And Noise,** Acoustics, Prof. R. Singh, singh.3@osu.edu, 2-9044, experimental and computational.
7. **Design And Development Of Wheeled Mobile Robots**, Robotics, Prof. J. Wang, wang.1381@osu.edu, 7-7275, design, experimental, and control.
8. **Modeling and Adaptive Control of Ground Vehicles with Time-Varying Inertial and Geometric Parameters**, Robotics, Prof. J. Wang, wang.1381@osu.edu, 7-7275, computational, analytical, and experimental.
9. **Dynamic Measurement of Blunt Thoracic, Liver, or Tibia Impacts**, Injury biomechanics, Prof. John Bolte, bolte.6@osu.edu, 688-4015, experimental.
10. **Structures with Electrically-Tuned Stiffness (Smart Vehicle Concepts Center).** Smart materials, Dynamics, and Design, Prof. M. Dapino, dapino.1@osu.edu, 688-3689, experimental and analytical.
11. **Smart Material Based Fuel Injectors (Smart Vehicle Concepts Center).** Smart materials, Dynamics, Mechanics, and Design, Prof. M. Dapino, dapino.1@osu.edu, 688-3689, experimental.
12. **Adaptive Metal-Matrix Composites with Embedded Smart Materials (Smart Vehicle Concepts Center),** Smart materials, Dynamics, Mechanics, and Design, Prof. M. Dapino, dapino.1@osu.edu, 688-3689, experimental and analytical.
13. **Smart Fabrics with Embedded Sensing and Actuation Functionality (Smart Vehicle Concepts Center),** Smart materials, Dynamics, Mechanics, and Design, Prof. M. Dapino, dapino.1@osu.edu, 688-3689, experimental and analytical.
14. **Mechanically Mediated Bone Growth.** Smart materials, Dynamics, and Design, Prof. M. Dapino, dapino.1@osu.edu, 688-3689, experimental and analytical.
15. **Actively Inducing Features and Textures on Surfaces.** Smart materials, Dynamics, and Design, Prof. M. Dapino, dapino.1@osu.edu, 688-3689, experimental and analytical.
16. **Design and Development of a Low-Noise Laser Measurement System for Atomic Force Microscopy**, Measurement and Control, Prof. C.H. Menq, menq.1@osu.edu, 2-4232, experimental and design.
17. **Magnetic Levitation**, Design, Measurement, and Control, Prof. C.H. Menq, menq.1@osu.edu, 2-4232, experimental and design.
18. **Design and Control of Magnetic Tweezers for Force Probing and Manipulation,** Measurement and Control, Prof. C.H. Menq, menq.1@osu.edu, 2-4232, design, analytical, and experimental.

19. **Characterization of Mechanotransduction in Cells**, Dynamics and Measurement, Prof. C.H. Menq, menq.1@osu.edu, 2-4232 and Professor Sissy Jhiang, jhiang.1@osu.edu, 24312, analytical and experimental.
20**. Li-ion Battery Characterization and Modeling for HEV and EV applications,** System Dynamics and Control, Prof. Yann Guezennec, Guezennec.1@osu.edu, experimental, modeling.
21**. Li-ion Battery Aging for HEV and EV applications,** System Dynamics and Control, Prof. Yann Guezennec, Guezennec.1@osu.edu , experimental.
22**. Li-ion Battery Aging Diagnostics and Prognostics,** System Dynamics and Control, Prof. Yann Guezennec and Giorgio Rizzoni, Guezennec.1@osu.edu , Rizzoni.1@osu.edu ,analytical, computational, experimental.
23. **Modeling of HEV and EV Battery Packs and Battery Management Systems**, System Dynamics and Control, Prof. Yann Guezennec, Guezennec.1@osu.edu, experimental, modeling.
21. **Energy Management and Control for Plug-in Hybrid Electric Vehicles,** System Dynamics and Control, Prof. Giorgio Rizzoni and Dr. Vincenzo Marano, Rizzoni.1@osu.edu and Marano.1@osu.edu, analytical, computational, experimental.
22. **Dynamics and Stability Control of a Hybrid-Electric Vehicle with Four-Wheel Electric Drive***,* Prof. Giorgio Rizzoni, Rizzoni.1@osu.edu, analytical, computational, experimental.
23. **Software Development for a Frequency Domain Near Infrared Tissue Oximeter And For A Portable Clinical Ultrasound**, Biomedical optical imaging, Prof. Ronald Xu, xu.202@osu.edu, 8-3635, programming and experimental.
24. **Dynamic Near Infrared Imaging with Ultrasound Guidance On Breast Simulating Tissue Phantoms**, Biomedical optical imaging, Prof. Ronald Xu, xu.202@osu.edu, 8-3635, experimental.
25. **Dynamic Near Infrared/Ultrasound Imaging for Breast Cancer Detection**, Biomedical optical imaging, Prof. Ronald Xu, xu.202@osu.edu, 8-3635, experimental.
26. **Near Infrared/MRI Detection of Ischemic Stroke on Rat Models**, Biomedical optical imaging, Prof. Ronald Xu, xu.202@osu.edu, 8-3635, experimental.
27. **Study of Oxygen Transportation and Angiogenesis Mechanism by Near Infrared Imaging on a Tissue Culture**, Biomedical optical imaging, Prof. Ronald Xu, xu.202@osu.edu, 8-3635, experimental.
28. **Development of a Fast Optical Switch and the Sensor Head for a Near Infrared Tissue Imaging System**, Biomedical, Prof. Ronald Xu, xu.202@osu.edu, 8-3635, experimental.
29. **Development of a Near Infrared/Ultrasound Dual Modal Handheld Imager for Dynamic Imaging of Optical and Mechanical Properties of Suspicious Breast Lesions**, Biomedical optical imaging, Prof. Ronald Xu, xu.202@osu.edu, 8-3635, experimental.
30. **Development of a Near Infrared Sensor Head for Brain Functional Study**, Biomedical optical imaging, Prof. Ronald Xu, xu.202@osu.edu, 8-3635, programming and experimental.
31. **Development of a Multimodal Dynamic Imaging System for Chronic Wound Assessment**. Biomedical optical imaging, Prof. Ronald Xu, xu.202@osu.edu, 8-3635, programming and experimental.
32. **Targeted Delivery of Contrast Agent Encapsulated Microspheres for Dynamic Cancer Imaging**. Biomedical optical imaging, Prof. Ronald Xu, xu.202@osu.edu, 8-3635, programming and experimental.
36. **Development of a Robotic Massage Device,** Biomedical Device, Prof. Y. Zhao, zhao.178@osu.edu, 7-7424, analytical and experimental.

37. **Real Time Data Analysis for Massage Therapy,** Biomedical Devices, Prof. Y. Zhao, zhao.178@osu.edu, 7-7424, programming and experimental.

Energy, Fluid and Thermal Systems, and Automotive Related Topics

1. **Diesel Combustion and Turbocharger Noise,** Combustion and Acoustics, Prof. A. Selamet, selamet.1@osu.edu, 2-4143, analytical and experimental.
2. **Effect of Charge Motion on Stressed Combustion in Spark-Ignition Engines,** Combustion and Fluid Mechanics, Prof. A. Selamet, selamet.1@osu.edu, 2-4143, experimental and computational.
3. **Design of Reactive and Hybrid Silencers for Engine Breathing Systems**. Fluid Mechanics and Acoustics, Prof. A. Selamet, selamet.1@osu.edu, 2-4143, analytical, experimental, and computational.
4. **Wave Tuning and Variable Valve Train in a Single-Cylinder Prototype Engine,** Wave Dynamics and Combustion, Prof. A. Selamet, selamet.1@osu.edu, 2-4143, experimental and computational.
5. **Alternative Fuels For Future Propulsion,** Energy and Combustion, Prof. A. Selamet, selamet.1@osu.edu, 2-4143, analytical and computational.
6. **Temperature Measurements In Oscillating Gas Flows,** Fluid Mechanics and Heat Transfer, Prof. A. Selamet, selamet.1@osu.edu, 2-4143, analytical and experimental.
7. **Renewable Power Generation with Solar Concentrators for Homes**, Energy systems, Prof. Y. Guezennec. Guezennec.1@osu.edu, experimental, numerical.
8. **Reducing Weight and Complexity of an Aircraft Wing by Using Flow Control over the Flap of the Wing**, Fluid dynamics, control, and laser diagnostics, Prof. M. Samimy, samimy.1@osu.edu, 2-6988, Experimental and numerical.
9. **Improving Propulsion Efficiency of a Supersonic Aircraft by Using Inlet Flow Control**, Fluid dynamics, propulsion, and laser diagnostics, Prof. M. Samimy, samimy.1@osu.edu, 2-6988, Experimental and numerical.
10. **Aircraft Jet Noise Mitigation**, Fluid dynamics, aeroacoustics, plasma actuators, and laser diagnostics, Prof. M. Samimy, samimy.1@osu.edu, 2-6988, Experimental and numerical
11. **CFD Modeling of Catalytic Converters,** Chemical, Thermal, and Fluids Engineering. Prof. Sandip Mazumder, mazumder.2@osu.edu, 247-8099, computational.
12. **CFD Modeling of Chemical Vapor Deposition of Aluminum Nitride**. Material Science and Chemical Engineering, Prof. Sandip Mazumder, mazumder.2@osu.edu, 247-8099, computational.
13. **Control of Advanced Multi-Mode Combustion Diesel Engines**, Prof. Junmin Wang, wang.1381@osu.edu, 247-7275, experimental computational, and analytical.
14. **Air-path Model Reduction of Complex Diesel Engines**, Prof. Junmin Wang, wang.1381@osu.edu, 247-7275, experimental, computational, and analytical.
15. **Control-Oriented Modeling of a Diesel Engine Selective Catalytic Reduction (SCR**), Prof. Junmin Wang, wang.1381@osu.edu, 247-7275, experimental and analytical.
16. **Control of a Diesel Engine Selective Catalytic Reduction (SCR) System,** Prof. Junmin Wang, wang.1381@osu.edu, 247-7275, experimental and analytical.
17. **Control-Oriented Modeling for Fuel-Property Adaptive Diesel Engine Control**, Prof. Junmin Wang, wang.1381@osu.edu, 247-7275, experimental and analytical.
18. **Rapid Prototyping Control System Development for Advanced Diesel Engine and Aftertreatment Systems**, Prof. Junmin Wang, wang.1381@osu.edu, 247-7275, experimental, programming, hardware, and analytical.

19. **Emissions Control for a Series Hybrid Electric Ethanol Engine,** IC engines, Dr. Shawn Midlam-Mohler, Midlam-Mohler.1@osu.edu, experimental.
20. **Control Development for a Advanced E85 Engine for use in an Hybrid Electric Vehicle**, IC engines, Dr. Shawn Midlam-Mohler, Midlam-Mohler.1@osu.edu, experimental.
21. **Characterization and Impact of Various Fuels (Including Electricity) for Ground Vehicles,** Thermal and Fluid Science and Engineering, Prof. Giorgio Rizzoni (.1) and Dr. Vincenzo Marano (.1), analytical, computational.
22. **Use of Thermoelectric Devices for Energy Recovery and Cooling in Automobiles,** Energy systems, Profs. Jos Heremans (.1), Greg Washington (.88), and Giorgio Rizzoni (.1), experimental, analytical.
23. **Electricity Generation from Solar Heat: Design of Solar Light Concentrators, Light Absorbers And Thermoelectric Power Generation**, Energy systems, Prof. Jos Heremans, Heremans.1@osu.edu, experimental, analytical.
24. **Motion Analysis of a Microdroplet,** Fluidic Mechanics, Prof. Y. Zhao, zhao.178@osu.edu, 7-7424, analytical and experimental.
25. **Blood Rheology in Microchannels**, Fluidic Mechanics, Prof. Y. Zhao, zhao.178@osu.edu, 7-7424, analytical and experimental.
26. **Motion Analysis of the Fluids in a Microfluific Chip,** Biomedical Microdevice, Prof. Y. Zhao, zhao.178@osu.edu, 7-7424, programming.
27. **Pressure-Assisted Micropatterning,** Biomedical Microdevice, Prof. Y. Zhao, zhao.178@osu.edu, 7-7424, analytical and experimental.
28. **Improving the Efficiency of Heat Pumps to Support the OSU Solar Decathlon Team.** Design and Thermal Systems, Prof. M. Walter, walter.80@osu.edu, 2-6081, experimental.
29. **Energy Analysis and Modeling to Support the OSU Solar Decathlon Team.** Heat Transfer and Controls, Prof. M. Walter, walter.80@osu.edu, 2-6081, numerical and analytical.
30. **Effect of Inlet Conditions on Flow Regimes in Two-Phase Flows,** Gas-liquid Two-phase Flows, Prof. X. Sun, sun.200@osu.edu, 7-7646, experimental.
31. **Dynamic Modeling of Flow Regime Evolution in Two-Phase Flows,** Gas-liquid Two-phase Flows, Prof. X. Sun, sun.200@osu.edu, 7-7646, analytical and **computational.**
32. **Effect of Diffusion Bonding Process on the Microstructure of High-Temperature Materials,** High-temperature Materials and Joining, Prof. X. Sun, sun.200@osu.edu, 7-7646, experimental.