# Proposed Undergrad Research Projects (1/17/14 draft)

**NOTE:**

**Projects in Black have been confirmed and updated with faculty members contact information. Projects in Red are from last year's list – it is possible that these are still current and valid. Don't hesitate to make contact with the faculty members if interested. Keep checking, as this list will be continuously updated and refined.**

**Do not be intimidated** by this list of projects! Talk to the faculty members about projects that interest you. 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-MAE 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 **undergraduate research proposal which is to be submitted to the College of Engineering via their website by the 6th Friday of Spring or Autumn Semester**. If any questions concerning the logistics, contact Professor Siston at siston.1@osu.edu.

## Applied Mechanics, Design, Manufacturing and Tribology Topics

1. **Automated Modeling and Optimization of Ceramic-Glass Composites Heterogeneous Microstructure**, Prof. S. Soghrati Computational solid mechanics, , soghrati.1@osu.edu, 2-2768, Modeling and optimization.
2. **Biomimetics Inspired Superoleophobic Surfaces**, System/Design, Prof. B. Bhushan, Bhushan.2@osu.edu, 2-0651, Experimental.
3. **Electrochemical Cell Design and Testing for Li-Ion Battery Applications**, System/Design, Prof. B. Bhushan, Bhushan.2@osu.edu, 2-0651, Experimental.
4. **Degradation Study of Ionic Liquids,** System/Design, Prof. B. Bhushan, Bhushan.2@osu.edu, 2-0651, Experimental.
5. **Fabrication of Nanostructures with Superhydrophobic Properties,** System/Design, Prof. B. Bhushan, Bhushan.2@osu.edu, 2-0651, Experimental.
6. **Adhesion Analysis of Hierarchical Morphology on Nanoscale,** Mechanics/Design, Prof. B. Bhushan, Bhushan.2@osu.edu, 2-0651, Modeling.
7. **Nanoscale Measurements using Atomic Force Microscopy for Nanotechnology**, System/Design, Prof. B. Bhushan, Bhushan.2@osu.edu, 2-0651, Experimental.

8. **Compliant mechanisms for design, modeling and fabrication for flapping wing micro air vehicles**, System/Design, Prof. Haijun Su, su.298@osu.edu, 2-2239, design, modeling and build
9. **Design of flexure mechanisms for ultra-high precision positioner and sensors**, System/Design, Prof. Haijun Su, su.298@osu.edu, 2-2239, design, modeling and build

**Dynamics, Control, and Smart Materials Topics**

1. **Experimental Characterization of Ion Rejection in Active Nanoporous Membranes for Desalination**, Prof. Sundaresan, sundaresan.19@osu.edu, 7-6367, experimental
2. **Open Source Electric Drivetrain Software - Platform Design and Android Software Development**, Prof. Sundaresan, sundaresan.19@osu.edu, 7-6367, modeling and code development
3. **Formation of Droplet Interface Bilayers towards the development of Bioderived Active Materials**, Prof. Sundaresan, sundaresan.19@osu.edu, 7-6367, experimental
4. **Understanding how people and other animals walk and run.** Prof. Manoj Srinivasan, srinivasan.88@osu.edu (phone not recommended) Various projects involving one or more of Experiments, Computer simulations, and Design/build/test.
5. **Intelligent estimation and control of traffic and vehicles based on communications,** Prof. Junmin Wang, E307, email: wang.1381@osu.edu
6. **Sensing and control of wheeled mobile robots**, Prof. Junmin Wang, E307, email: wang.1381@osu.edu
7. **Engineering Graphene Films on Textured Surfaces**, Prof. Shaurya Prakash, prakash.31@osu.edu, 8-4045, experimental.
8. **Load Monitoring Procedures for Bearings Based on Vibration Measurements** (sponsored by the Smart Vehicle Concepts Center), System Dynamics, Kinematics, and Vibration, Prof. R. Singh, singh.3@osu.edu, 2-9044 and Dr. J. Dreyer dreyer.24@osu.edu, computational, signal processing, and experimental.
9. **Adaptive Hydro-Bushing Design for Vehicle Suspension System** (sponsored by the Smart Vehicle Concepts Center), System Dynamics and Vibration, Prof. R. Singh, singh.3@osu.edu, 2-9044, and Dr. J. Dreyer <dreyer.24@osu.edu>, design, experimental, and computational.
10. **Characterization of Magnetic Gear Drives,** Kinematics, Dynamics, and Electromechanical Systems, Prof. R. Singh, singh.3@osu.edu, 2-9044 and Dr. J. Dreyer dreyer.24@osu.edu, design, computational, and experimental.
11. **Interfacial Forces Measurement Techniques for Vehicle Clutch Assembly,** System Dynamics and Stress Analysis, Prof. R. Singh, singh.3@osu.edu, 2-9044 and Dr. J. Dreyer dreyer.24@osu.edu, design, computational, and experimental.
12. **Measurement of Vehicle Braking Forces**, System Dynamics and Stress Analysis, Dr. J. Dreyer dreyer.24@osu.edu, and Prof. R. Singh, singh.3@osu.edu, 2-9044, design and experimental.

13. **Effect of Surface Profile on Contact Stiffness Variations**, Measurements and Vibration, Dr. J. Dreyer <dreyer.24@osu.edu> and Prof. R. Singh, singh.3@osu.edu, 2-9044, analytical, experimental, computational.
14. **Dynamic Analysis of Guide Pins in Linear Actuators,** Kinematics, System Dynamics and Vibration, Dr. J. Dreyer <dreyer.24@osu.edu> and Prof. R. Singh, singh.3@osu.edu, 2-9044, experimental and computational.
15. **Design of a Test Chamber to Characterize Acoustic Materials,** Acoustics and Design, Dr. J. Dreyer dreyer.24@osu.edu, Tel: 906-370-4972 and Prof. R. Singh, singh.3@osu.edu, 2-9044, design and experimental.
16. **Tunable Rubber Isolators**, Design and Vibration, Dr. J. Dreyer dreyer.24@osu.edu, Tel: 906-370-4972 and Prof. R. Singh, singh.3@osu.edu, 2-9044, design and experimental.

**Energy, Fluid and Thermal Systems, and Automotive Related Topics**

1. **Aircraft Jet Noise Mitigation**, Fluid dynamics, aeroacoustics, plasma actuators, and laser diagnostics, Prof. M. Samimy, samimy.1@osu.edu, 2-6988, Experimental and numerical.
2. **Flow Control over an Aircraft Wing**, Fluid dynamics, aerodynamics, plasma actuators, and laser diagnostics, Prof. M. Samimy, samimy.1@osu.edu, 2-6988, Experimental.
3. **Aircraft Jet Noise Mitigation**, Fluid dynamics, aeroacoustics, plasma actuators, and laser diagnostics, Prof. M. Samimy, samimy.1@osu.edu, 2-6988, Experimental and numerical.
4. **Flow Control over an Aircraft Wing**, Fluid dynamics, aerodynamics, plasma actuators, and laser diagnostics, Prof. M. Samimy, samimy.1@osu.edu, 2-6988, Experimental.
5. **Control of Resonating Flows in Aircraft Applications,** Fluid dynamics, aerodynamics, plasma actuators, and laser diagnostics, Prof. M. Samimy, samimy.1@osu.edu, 2-6988, Experimental, Analytical.
6. **Flow control applications to Turbomachinery**, Prof. J. Bons, bons.2@osu.edu, experimental fluid mechanics, blowing/suction flow control, laser diagnostics.
7. **Advanced film cooling applications in Gas Turbines**, Prof. J. Bons, bons.2@osu.edu, experimental fluid mechanics and heat transfer, infrared imagery, laser diagnostics.
8. **Mechanics of airborne particle impact and deposition at high temperatures**, Prof. J. Bons, bons.2@osu.edu, experimental fluid mechanics, solid mechanics modeling, high speed imaging.
9. **Thermal Modeling of Li-Ion Batteries, Energy Systems**, Prof. M. Canova. Canova.1@osu.edu, modeling, analytical.
10. **Electrochemical and Thermal Analysis of Li-ion Battery Cells**, Energy Systems, Prof. M. Canova, Canova.1@osu.edu, experimental.
11. **Development of Fast-Response Pressure-Sensitive Paint**, fluid dynamics, advanced diagnostics, Prof. J. Gregory, gregory.234@osu.edu, 292-5024, experimental.
12. **Flow Control of Separated Wakes, fluid dynamics, bluff body wakes**, Prof. J. Gregory, gregory.234@osu.edu, 292-5024, experimental.
13. **Rotorcraft Dynamic Stall**, unsteady fluid dynamics, helicopters, unsteady compressibility effects – Prof. J. Gregory, gregory.234@osu.edu, 292-5024, experimental.

14. **Unmanned Aircraft**, flight testing, flow control on UAVs, detect-and-avoid other aircraft – Prof. J. Gregory, gregory.234@osu.edu, 292-5024, experimental.
15. **Prediction of Turbine Stage Performance**, Aerodynamics, heat transfer, computational fluid dynamics, Prof. M. Dunn, dunn.129@osu.edu, 2-5015, and Dr. R. Mathison, mathison.4@osu.edu, 2-5074, computational, data analysis.
16. **Development of Miniaturized Data Acquisition and Storage Electronics**, Electronics, data signal conditioning, aerodynamics, Prof. M. Dunn, dunn.129@osu.edu, 2-5015, and Dr. R. Mathison, mathison.4@osu.edu, 2-5074, design, experimental.
17. **Streamlining Processing for Large Turbine Data Sets**, Aerodynamics, heat transfer, LabView programming, Prof. M. Dunn, dunn.129@osu.edu, 2-5015, and Dr. R. Mathison, mathison.4@osu.edu, 2-5074, computational, data analysis.
18. **Development of New Heat-Flux Gauges**, Heat transfer, micro-assembly, Prof. M. Dunn, dunn.129@osu.edu, 2-5015, and Dr. R. Mathison, mathison.4@osu.edu, 2-5074, design, manufacture, experiment.
19. **Combustion Kinetics and Knock in Engines**, Energy, Combustion, and Engines, Prof. A. Selamet, selamet.1@osu.edu, 2-4143, analytical, computational, and experimental.
20. **Stall and Surge in Turbocharger Compressors**, Wave Dynamics, Fluid Mechanics, and Engines, Prof. A. Selamet, selamet.1@osu.edu, 2-4143, experimental and computational.
21. **Turbocharger Noise**, Acoustics, Fluid Mechanics, and Engines, Prof. A. Selamet, selamet.1@osu.edu, 2-4143, analytical and experimental.
22. **Advanced Energy Conversion in Engines,** Energy, Combustion, and Engines, Prof. A. Selamet, selamet.1@osu.edu, 2-4143, analytical and computational.
23. **Building energy modeling software: implementation, comparison, and validation**, Prof. Mark Walter, walter.80@osu.edu, 2-6081, modeling, computer programming, analytical.
24. **Characterization of NextCell Solid Oxide Fuel Cell Electrolytes with Digital Image Correlation**, Prof. Mark Walter, walter.80@osu.edu, 2-6081, experimental, finite element modeling.
25. **Biomimetic nanostructures for fuel cells**, Prof. Shaurya Prakash, prakash.31@osu.edu, 8-4045, experimental.
26. **Nanostructures for drag reduction on ground fleet vehicles**, Prof. Shaurya Prakash, prakash.31@osu.edu, 8-4045, experimental.
27. **Biomimetic nanostructures for high efficiency heat exchangers**, Prof. Shaurya Prakash, prakash.31@osu.edu, 8-4045, experimental.
28. **Purification of water from shale energy drilling wells**, Prof. Shaurya Prakash, prakash.31@osu.edu, 8-4045, experimental and computational
29. **Portable Thermoelectric Power Generator: a Small Portable Combustion Chamber and Metallic Thermoelectric Elements in a Small Pile to Make Electric Power Directly from a Fossil Fuel**, Profs. Jos Heremans Heremans.1@osu.edu and Shaurya Prakash prakash.31@osu.edu, experimental.

**Bio-engineering Area Topics**

1. **Understanding how people and other animals walk and run.** Prof. Manoj Srinivasan, srinivasan.88@osu.edu (phone not recommended) Various projects involving one or more of Experiments, Computer simulations, and Design/build/test.

2. **Durability of Dental Restorations**, Materials, Mechanics, Design, Prof. N. Katsube, katsube.1@osu.edu, 2-0971, computational, analytical and experimental.
3. **Mechanics of Cartilage**, Biomechanics, Materials, Design, Prof. N. Katsube, katsube.1@osu.edu, 2-0971, computational.
4. **Air-Puff Characterization for Inter-Ocular Pressure Measurement**, Prof. J. Bons, bons.2@osu.edu, experimental fluid mechanics, laser diagnostics.
5. **Optimizing Component Alignment in Total Knee Replacement,** Prof. R. Siston, Siston.1@osu.edu, 7-2721, computational.
6. **Simulations of Muscle Weakness During Movement,** Prof. R. Siston, Siston.1@osu.edu, 7-2721, computational.
7. **Impedance imaging instrument development for biological tissues,** Prof. Shaurya Prakash, prakash.31@osu.edu, 8-4045, experimental.
8. **Phantom design and testing for impedance imaging of head trauma,** Prof. Shaurya Prakash, prakash.31@osu.edu, 8-4045, experimental.
9. **Biomechanical Modeling of Cancer Metastasis**, Prof. S. Ghadiali, ghadiali.1@osu.edu 2-7742, Computational with experimental input
10. **Biomechanical Modeling of Upper Respiratory Infections and Ear Disease**, Prof. S. Ghadiali, ghadiali.1@osu.edu 2-7742, Computational
11. **Modularized Microfluidic Devices by 3D Printing,** Prof. Y. Zhao, zhao.178@osu.edu, 7-7424, experimental.
12. **Wearable Sensor Network for Body Motion Detection in Open Space**, Prof. Y. Zhao, zhao.178@osu.edu, 7-7424, programming and experimental.

**Nuclear Engineering Topics**