Students Representing Ohio Congressional Districts
# TABLE OF CONTENTS

Table of Contents..................................................................................................................ii-iii

Description of Fellowship and Scholarship Program ............................................................. iv

Membership ................................................................................................................................v

Ohio Congressional Map ........................................................................................................ vi

<table>
<thead>
<tr>
<th>Scholar / Fellow</th>
<th>College / University</th>
<th>Page(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allen, Joshua E.</td>
<td>Wilberforce University</td>
<td>58</td>
</tr>
<tr>
<td>Altman, Katrina J.</td>
<td>The Ohio State University</td>
<td>48</td>
</tr>
<tr>
<td>Anderson, Makeba A.</td>
<td>Central State University</td>
<td>18</td>
</tr>
<tr>
<td>Austin, Christian D.</td>
<td>The Ohio State University</td>
<td>49-49a</td>
</tr>
<tr>
<td>Barnes, Caleb J.</td>
<td>Wright State University</td>
<td>63</td>
</tr>
<tr>
<td>Betten, Joseph F.</td>
<td>Central State University</td>
<td>19</td>
</tr>
<tr>
<td>Blake, Bailey M.</td>
<td>Ohio Northern University</td>
<td>43</td>
</tr>
<tr>
<td>Bodnar, Karin E.</td>
<td>The University of Akron</td>
<td>2</td>
</tr>
<tr>
<td>Boyd, Eileen N.</td>
<td>The University of Akron</td>
<td>3</td>
</tr>
<tr>
<td>Bozak, Richard F., Jr.</td>
<td>Cleveland State University</td>
<td>29</td>
</tr>
<tr>
<td>Bradford, Robyn L.</td>
<td>Central State University</td>
<td>20</td>
</tr>
<tr>
<td>Bridges, Royel S.</td>
<td>Wilberforce University</td>
<td>59</td>
</tr>
<tr>
<td>Burba, Micheal Eric</td>
<td>Central State University</td>
<td>21</td>
</tr>
<tr>
<td>Carrington, Kenya P.</td>
<td>Wilberforce University</td>
<td>60</td>
</tr>
<tr>
<td>Cass, Dwight P., Jr.</td>
<td>Wilberforce University</td>
<td>61</td>
</tr>
<tr>
<td>Casto, Michael Wes</td>
<td>Marietta College</td>
<td>40</td>
</tr>
<tr>
<td>Charvat, Robert C.</td>
<td>University of Cincinnati</td>
<td>23-23a</td>
</tr>
<tr>
<td>Croston, Ryan T.</td>
<td>The University of Akron</td>
<td>4</td>
</tr>
<tr>
<td>Elbuluk, Osama M.</td>
<td>The University of Akron</td>
<td>1</td>
</tr>
<tr>
<td>Fisher, Kevin E.</td>
<td>University of Dayton</td>
<td>37</td>
</tr>
<tr>
<td>Frias, Julian S.</td>
<td>University of Dayton</td>
<td>38</td>
</tr>
<tr>
<td>Friedlein, Amy N.</td>
<td>Ohio Northern University</td>
<td>44</td>
</tr>
<tr>
<td>Genuske, Megan E.</td>
<td>Youngstown State University</td>
<td>69</td>
</tr>
<tr>
<td>Gerlach, Adam R.</td>
<td>University of Cincinnati</td>
<td>24</td>
</tr>
<tr>
<td>Grage, Danielle L.</td>
<td>University of Cincinnati</td>
<td>25</td>
</tr>
<tr>
<td>Greenfield, Amy J.</td>
<td>Cedarville University</td>
<td>9</td>
</tr>
<tr>
<td>Guernsey, Jonathan J.</td>
<td>The University of Toledo</td>
<td>54-54a</td>
</tr>
<tr>
<td>Harpole, Bethany G.</td>
<td>Cedarville University</td>
<td>10</td>
</tr>
<tr>
<td>Heinig, Peter I.</td>
<td>Wright State University</td>
<td>64</td>
</tr>
<tr>
<td>Herrmann, Nathaniel J.</td>
<td>Wright State University</td>
<td>65</td>
</tr>
<tr>
<td>Hilderbrand, Jaclyn K.</td>
<td>Cedarville University</td>
<td>11</td>
</tr>
<tr>
<td>Hoersten, Douglas J.</td>
<td>Ohio Northern University</td>
<td>45-45a</td>
</tr>
<tr>
<td>Howard, D'Nita M.</td>
<td>Wilberforce University</td>
<td>62</td>
</tr>
<tr>
<td>Hudak, Marguerite J.</td>
<td>The University of Akron</td>
<td>5</td>
</tr>
<tr>
<td>Huelsmann, Andrew P.</td>
<td>University of Dayton</td>
<td>39</td>
</tr>
<tr>
<td>Hunt, Alexander J.</td>
<td>Case Western Reserve University</td>
<td>7</td>
</tr>
<tr>
<td>Johnson, Jimetric Y.</td>
<td>Cleveland State University</td>
<td>30</td>
</tr>
<tr>
<td>Jonell, Michael A.</td>
<td>Wright State University</td>
<td>66</td>
</tr>
<tr>
<td>Scholar / Fellow</td>
<td>College / University</td>
<td>Page(s)</td>
</tr>
<tr>
<td>----------------------------</td>
<td>---------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Juhl, Jonathan F.</td>
<td>Cedarville University</td>
<td>12-12a</td>
</tr>
<tr>
<td>Kecskemety, Krista M.</td>
<td>The Ohio State University</td>
<td>50-50a</td>
</tr>
<tr>
<td>Knapke, Robert D.</td>
<td>University of Cincinnati</td>
<td>26</td>
</tr>
<tr>
<td>Lemke, Sean P.</td>
<td>Ohio Northern University</td>
<td>46</td>
</tr>
<tr>
<td>Mallory, Christopher D.</td>
<td>Columbus State Community College</td>
<td>35</td>
</tr>
<tr>
<td>Martin, Michele M.</td>
<td>Owens Community College</td>
<td>52</td>
</tr>
<tr>
<td>McConnell, Aimee Lee</td>
<td>Cleveland State University</td>
<td>31</td>
</tr>
<tr>
<td>Murry, Maisha M.</td>
<td>University of Cincinnati</td>
<td>27-27a</td>
</tr>
<tr>
<td>Neff, David N.</td>
<td>Wright State University</td>
<td>67</td>
</tr>
<tr>
<td>Noble, Garrett J.</td>
<td>Cedarville University</td>
<td>13</td>
</tr>
<tr>
<td>Orra, Mike</td>
<td>The University of Toledo</td>
<td>55-55a</td>
</tr>
<tr>
<td>Palmer, Hallee M.</td>
<td>Cedarville University</td>
<td>14</td>
</tr>
<tr>
<td>Paslay, Paul M.</td>
<td>Marietta College</td>
<td>41</td>
</tr>
<tr>
<td>Porché, Monica A.</td>
<td>Central State University</td>
<td>22</td>
</tr>
<tr>
<td>Powers, Jaelynn E.</td>
<td>Owens Community College</td>
<td>53</td>
</tr>
<tr>
<td>Rader, John Matthew</td>
<td>Ohio Northern University</td>
<td>47</td>
</tr>
<tr>
<td>Ratliff, Mark A.</td>
<td>Cedarville University</td>
<td>15</td>
</tr>
<tr>
<td>Rippl, Matthew D.</td>
<td>Wright State University</td>
<td>68</td>
</tr>
<tr>
<td>Rivera, Alexander Lee</td>
<td>Case Western Reserve University</td>
<td>8</td>
</tr>
<tr>
<td>Roth, Emily E.</td>
<td>The University of Toledo</td>
<td>56</td>
</tr>
<tr>
<td>Sadeghipour, Ehsan</td>
<td>The Ohio State University</td>
<td>51</td>
</tr>
<tr>
<td>Slonecker, Holly N.</td>
<td>Miami University</td>
<td>42</td>
</tr>
<tr>
<td>Smith, David M.</td>
<td>Columbus State Community College</td>
<td>36</td>
</tr>
<tr>
<td>Snell, Andrew J. R.</td>
<td>Cleveland State University</td>
<td>32</td>
</tr>
<tr>
<td>Steinberger, Miranda L.</td>
<td>The University of Toledo</td>
<td>57</td>
</tr>
<tr>
<td>Steinmetz, Jarrod C.</td>
<td>Cedarville University</td>
<td>16</td>
</tr>
<tr>
<td>Studmire, Brittany M.</td>
<td>Cleveland State University</td>
<td>33</td>
</tr>
<tr>
<td>Tatarko, John L.</td>
<td>Cleveland State University</td>
<td>34</td>
</tr>
<tr>
<td>Verhoff, Ashley M.</td>
<td>University of Cincinnati</td>
<td>28</td>
</tr>
<tr>
<td>Vo, Thomas V.</td>
<td>The University of Akron</td>
<td>6</td>
</tr>
<tr>
<td>Weston, John T.</td>
<td>Cedarville University</td>
<td>17</td>
</tr>
</tbody>
</table>
FELLOWSHIP AND SCHOLARSHIP PROGRAM

The Ohio Space Grant Consortium (OSGC), a member of the NASA National Space Grant College and Fellowship Program, supports graduate fellowships and undergraduate scholarships for students studying in an Aerospace-related discipline. The awards are made to United States citizens, and since 1989, more than $4.1 million in financial support has been awarded to approximately 525 undergraduate scholars and 157 graduate fellows working toward degrees in Science, Technology, Engineering and Mathematics (STEM) disciplines at OSGC member universities. The students are competitively selected from hundreds of applicants.

Funds for the fellowships and scholarships are provided by the National Space Grant Program. Matching funds are provided by the member universities, the Ohio Aerospace Institute (OAI), and private industry. Note that this year approximately $400,000 will be directed to scholarships and fellowships representing contributions from NASA, Ohio Aerospace Institute, member universities, and industry.

By helping more students to graduate with Aerospace-related degrees, OSGC provides more qualified technical employees to industry. This will assist in alleviating current and predicted shortages of technical professionals. At the Doctoral level, students have a government co-advisor in addition to their faculty mentor, and spend time in residence at one of Ohio's two federal laboratories: John H. Glenn Research Center at Lewis Field or the Air Force Research Laboratories at Wright-Patterson Air Force Base. The research conducted for the Master's and Doctoral degrees must be of interest to NASA. A prime aspect of the scholarship program is the undergraduate research project that the student does under the mentorship of a faculty member. This research experience is effective in encouraging U.S. undergraduate students to attend graduate school in Engineering or the Sciences.

**Affiliate Members**
- Air Force Institute of Technology
- The University of Akron
- Case Western Reserve University
- Cedarville University
- Central State University
- Cleveland State University
- Cleveland State University
- University of Dayton
- Ohio Northern University
- The Ohio State University
- Ohio University
- The University of Toledo
- Wilberforce University
- Wright State University

**Participating Universities**
- Marietta College
- Miami University
- Youngstown State University

**Community Colleges**
- Columbus State Community College
- Cuyahoga Community College
- Lakeland Community College
- Lorain County Community College
- Owens Community College
- Terra Community College

Ohio Space Grant Consortium • 22800 Cedar Point Road • Cleveland, Ohio 44142
MEMBERSHIP

Management

Dr. Paul C. Lam
Director
Ohio Space Grant Consortium
The University of Akron

Ms. Laura A. Stacko
Program Manager
Ohio Space Grant Consortium

Dr. Gerald T. Noel, Sr.
Associate Director
Ohio Space Grant Consortium
Central State University

Ms. Ann O. Heyward
Vice President of Research and
Educational Programs
Ohio Aerospace Institute

Dr. Gerald T. Noel, Sr.
Associate Director
Ohio Space Grant Consortium
Central State University

Ms. Arela B. Leidy
Program Assistant
Ohio Space Grant Consortium

Ms. Laura A. Stacko
Program Manager
Ohio Space Grant Consortium

Member Institutions

Dr. Jonathan T. Black
Air Force Institute of Technology

Dr. J. Iwan D. Alexander
Case Western Reserve University

Dr. Robert Chasnov, P. E.
Cedarville University

Dr. Gerald T. Noel, Sr.
Central State University

Ms. Pamela C. Charity
Cleveland State University

Dr. Jed E. Marquart, P. E.
Ohio Northern University

Dr. Füsun Özugüner
The Ohio State University

Dr. James M. Rankin, P. E.
Ohio University

Dr. Paul C. Lam
The University of Akron

Dr. Gary L. Slater
University of Cincinnati

Dr. Malcolm W. Daniels
University of Dayton

Dr. D. Ramon Hixon
The University of Toledo

Dr. Edward Asikele
Wilberforce University

Dr. P. Ruby Mawasha
Wright State University

Participating Institutions

Dr. Benjamin H. Thomas
Marietta College

Dr. Osama Ettouney
Miami University

Dr. Hazel Marie
Youngstown State University

Community Colleges

Professor Jeffery M. Woodson
Columbus State Community College

Ms. Sandy L. Robinson
Cuyahoga Community College

Dr. Frederick W. Law
Lakeland Community College

Dr. George Pillainayagam
Lorain County
Community College

Dr. Bruce Busby
Owens Community College

Dr. James Bighouse
Terra Community College

Industry Sponsors

ArcelorMittal
Space Explorers, Inc.
The TRW Foundation

Government Liaisons

Mr. James B. Fitzgerald
NASA Glenn Research Center

Dr. M. David Kankam
NASA Glenn Research Center

Mr. Robert F. LaSalvia
NASA Glenn Research Center

Ms. Kathleen Levine
Wright-Patterson Air Force Base

Ms. Alice Fay Noble
Wright-Patterson Air Force Base

Ms. Kathleen Schweinfurth
Wright-Patterson Air Force Base

Educational Liaisons

Ms. Pamela Bowers
Drake Planetarium

Mr. Joseph M. Renaud
Aerospace and Defense Advisor -
State of Ohio

Dr. Jay N. Reynolds
Walter R. Schuele Planetarium
Osama M. Elbuluk

**Status:** Senior, Mechanical Engineering

**Research Topic:** Flow-Induced Vibrations of Carbon Nanotubes

**Advisor(s):** Dr. S. Graham Kelly, III

**Biography:** I am a Junior Mechanical Engineering student at The University of Akron. I will be graduating next Spring and hope to attend medical school after graduation. I have always been fascinated by math and science, so upon entering college I thought that being an engineering major just made sense. I enjoyed my course work, but never found myself excited about the future possibility of becoming an engineer. I decided to explore other possible career options, and through shadowing and volunteer experiences, I realized that perhaps I wanted to become a physician. I began taking the proper pre-medical coursework in conjunction with my mechanical engineering curriculum, and as time passed I became convinced that studying medicine was the route I wanted to take. Although I may not continue my engineering education after graduation, I am very thankful of the opportunities being an engineering student has provided me. It has led me to become very fond of research, and I plan on continuing research post-graduation, just in more health-related fields.

**Abstract:** Flow induced vibrations of single and double-walled carbon nanotubes are studied using pipe models. The solutions to flow induced vibrations of pipes are well known. Buckling and flutter are two instabilities of concern. The problem formulation, governing differential equation and dimensionless frequency response for single-walled nanotubes are similar to that of pipes of conveying fluids. The Van der Waals forces between the layers of multiwalled nanotubes are modeled as springs. This changes the governing differential equation and the dimensionless frequency response for the double-walled nanotubes. This research provides results for fixed-fixed boundary conditions.

**Publications:** None yet.

**Congressional District(s):** 13th

**Congressional Representative(s):** Betty Sutton
Karin E. Bodnar

Status: Junior, Electrical Engineering
Research Topic: Impedance Simulation and Testing of Lithium-Ion Batteries

Advisor(s): Dr. Paul C. Lam

Biography: I am currently a Junior Electrical Engineering student at The University of Akron. While at Akron, I have been an active member of the Institute of Electrical and Electronic Engineers (IEEE), the Women in Engineering Program (WIEP), and the Tau Beta Pi Engineering Honors Society. I have served in several leadership positions, including President of the Akron Honors Club, Treasurer of the Engineering Student Council, and Regional Collegiate Newsletter Editor for the Society of Women Engineers (SWE).

For the past two summers, I have had the opportunity to intern at the NASA Glenn Research Center as a LERCIP student. From this internship experience, I discovered my passion for research and my interest in aerospace. I plan to graduate from the University of Akron with my bachelor’s degree in Electrical Engineering with a minor in Applied Mathematics in 2011. After graduation, I plan to attend graduate school to earn my Master’s Degree.

Abstract: Over the past several years, one specific focus of the Electrochemistry Branch at the NASA Glenn Research Center has been the development of human-rated, Lithium-Ion battery systems for space applications. Presently, the Lithium-Ion battery chemistry is being evaluated, analyzed, tested, and qualified for the Constellation Project. My project will focus on the modeling of two specific Lithion Lithium-Ion battery cells for space applications. This analysis will consist of collecting battery cell data using an Impedance Measurement System (IMS) and a Wayne-Kerr Impedance Measurement System. Based on the collected data, an eight-cell battery model will be created using simulation software. From the analysis and testing of the Lithion batteries, the eight-cell battery model will be updated and validated.

The newly updated Lithium-Ion battery model will then be used to update the existing Ares I Upper Stage (US) Electrical Power System (EPS) simulation. The updated simulation will then more accurately reflect the characteristics of the battery, including its internal impedance, and will more precisely predict the performance of Lithium-Ion Batteries in the Ares I US EPS. The qualification of the EPS, including the Lithium-Ion battery components, will then be accomplished from both running mission-specific simulations on the model and from testing in the laboratory.

Publications: None yet.
## Eileen N. Boyd

### Status: Junior, Chemical Engineering


### Advisor(s): Dr. Paul C. Lam, Dr. Julie Zhao, and Dr. Edward Evans

### Biography: I am currently a Junior majoring in Chemical Engineering. My favorite hobbies are watching television (sports, game shows, and comedies) and movies, playing video games, and listening to music. My favorite subjects in school are math and science. I decided to major in Chemical Engineering because when I was a child, I loved building things with blocks and reading books about chemistry and the earth’s features and natural phenomena (thunderstorms, earthquakes, volcanoes, etc.). For my career, I would love to be involved in something that involves chemical engineering and aerospace, because I love things dealing with space like the stars, moon, and planets.

### Abstract: A-123 Lithium Iron Phosphate cells for testing spacesuits project is used to build a single battery that will be used to power all of the functions of the spacesuit like the helmet light, pistol grip, and the circulation of oxygen. Currently, the spacesuit is heavy because of the different types of batteries used to power each function of the spacesuit, so a small and lightweight battery would be desired. Also the battery must be able to operate at a wide range of temperatures and discharge for a 4 hour Extravehicular Activity (EVA) mission. The battery could either discharge for a full 8 hour mission or discharge for 4 hours, recharge quickly, and discharge for another 4 hours. The cells are prepared for testing by placing them into holders and connecting wires to them. Then the cells are connected to thermocouples inside the environmental chamber where they will be tested at -20°C, 0°C, and 20°C. The -20°C is the temperature at which the cells would operate at cold lunar temperature.

### Publications: None yet.

<table>
<thead>
<tr>
<th>Congressional District(s):</th>
<th>13th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congressional Representative(s):</td>
<td>Betty Sutton</td>
</tr>
</tbody>
</table>
Status: Junior, Chemical Engineering

Research Topic: Optical Switches

Advisor(s): Dr. Stephen Cheng and Dr. Matthew Graham

Biography: Ryan Croston was valedictorian of his senior class at Heritage Christian School in Canton, Ohio. While in high school, he was a member of band and choir. He played on the varsity soccer team and was a co-captain for the varsity baseball team. During this time, he received his Eagle Scout Award with a set of all three palms in Boy Scouts of America.

In the Fall of 2006, Ryan started attending college at Cedarville University, later to transfer to The University of Akron. While he was at Cedarville, he was the vice president of the Cedarville Chess Team, as well as an active member in the Multicultural Community. He transferred to The University of Akron in the Summer of 2007, where he quickly joined the IDEAs program (Increasing Diversity in Engineering Academics). He also switched his major to Chemical Engineering. While at Akron, Ryan has been active in Campus Focus, a Christian outreach to the campus, as well as working at Babcock and Wilcox for his Co-operative studies, where a student is placed in the work setting to gain knowledge of what a possible future job may look like.

Abstract: To improve the rate of communication and computation, sub-pico second switches are desired. A potential technical approach to fabricate a sub-pico second switch relies on a third-order photo-refractive mechanism. Initial designs of all-optical switches have been evaluating using transfer matrix calculations. The most promising design used consists of a stack of alternating dielectric layers topped with a single optically active organic layer. Changes in the intensity of incoming light cause the switch to turn on and off. I set out to optimize the switch design by simulating the affect of several key characteristics such as refractive index change, organic layer thickness, and incident angle on switching efficiency. Again, a transfer matrix calculation method was used to determine the transmission difference between the on and off states of the switch. Based on these results, the effect of these design parameters on switching efficiency were determined.

Publications: None yet.
Marguerite J. Hudak

Status: Senior, Middle Childhood Education, Science and Mathematics
Research Topic: Discovering Properties of Stars: Color, Luminosity, and Temperature
Advisor(s): Dr. Paul C. Lam

Biography: I am currently a senior at The University of Akron working towards a Bachelor's Degree in Education. Science and mathematics have always been my favorite subjects in school, and that is the main reason why I chose them as my areas of concentration. It is my goal to one day be the kind of teacher who encourages and excites children about learning these subjects. As a future educator, I feel that it is my responsibility to provide children with an education that will inspire them to be the best they can be. Outside of school, I am an active member of my church as I volunteer my time to teach for the children’s ministry and also sing on the worship team. My current job also involves work with children, since I work for the YMCA’s School Age Child Care program. I feel very fortunate to be given the opportunity to bless the lives of so many children, while they have touched my heart as well.

Abstract: My project will explain and demonstrate how to calculate the luminosity and temperature of various stars and show how they affect the colors of stars. This will be explained through the use of Wien’s law which states that the wavelength at which an object radiates most strongly is inversely proportional to the object’s temperature. Hotter stars radiate more strongly at shorter wavelengths, and stars that have a red glow are cool, while stars that have a blue glow are hot. Also, the Stefan-Boltzmann law will be used to illustrate that the total amount of light emitted by an object increases as its temperature rises. In other words, luminosity increases as temperature rises.

Publications: None yet.
**Biography:** My name is Tom Vo, and I am a graduate student at The University of Akron. I am pursuing a Master’s Degree in Electrical Engineering and intend on graduating in May, 2010. I grew up in Twinsburg, Ohio, and went to Twinsburg High School. At Twinsburg High School I was able to participate in my first robotics competition. I had such a great time working with robotics that I went on and competed in other robotics competitions including BattleBots IQ, the high school version of the famous fighting robot competition. My interest in robotics is what made me decide to take the path of becoming an electrical engineer. This is also the reason behind why my undergraduate Senior Design Project was a robot for the Fire-Fighting Robot Competition hosted annually at Trinity College. I decided to continue my education because of my interest in the field of Control Systems. My hope is that I will someday be able to have a career that is related to the field of robotics.

**Abstract:** A large battery-pack array will be used for an electric automotive vehicle. System identification will be performed on the large rechargeable battery array in order to obtain a model for it. This in turn will be used to generate an observer that will be programmed onto an embedded controller for each individual pack in the array. This will allow for the state-of-charge of each battery pack to be given at any time. Simulations will be conducted with the models obtained and will be verified by tests using the physical system. The overall goal for this project is to be able to give the state-of-charge of the array in order to properly monitor and control the charging and discharging of the batteries.

**Publications:** None yet.
Alexander J. Hunt

**Status:** Senior, Mechanical Engineering

**Research Topic:** Design and Fabrication of a Biologically Inspired Robot for Lunar Exploration and Regolith Collection

**Advisor(s):** Dr. Roger Quinn

**Biography:** I am a fourth-year student in Mechanical Engineering at Case Western Reserve University. I come from a family of engineers; my grandfather was a chemical engineer, and both my father and older brother are electrical engineers. As a child I was given all the proper toys to shape my mind: Legos, K-nex, Erector Set, etc. I loved building the sets I was given, but mostly I loved modifying them to increase performance, or create alternative functions. Little did I know, all this would send me down a path towards Mechanical Engineering. After interviewing Dr. Roger Quinn for a course my freshman year, I became very interested in the robotics research at Case Western Reserve University, and the opportunities it held. Sophomore year, I worked my way in to Dr. Quinn's Biologically Inspired Robotics lab doing menial jobs. Though he had no research opportunities at the time, I still wished to be around the work, as the integration of biology into robotics fascinated me. Eventually something opened up, and I was given the opportunity to work with a master’s student on building a robot for NASA, Lunar Whegs™. I have continued to work in Dr. Quinn’s Lab, and plan on working towards a Masters in Mechanical Engineering with him over the next year.

**Abstract:** NASA is working on a project to have permanent human presence on the moon’s surface and needs a way to get oxygen on the moon. NASA scientists plan to extract this from the material on the moon’s surface called regolith (regolith is like soil but without organic material). Robots will be used for this mining operation because it is impractical and dangerous for astronauts to collect the regolith. The top few centimeters of regolith is loosely packed and finer than sand. Surface mining will be done by a vehicle that can maneuver on top of the regolith and scoop it up for transport to the processing facility. Philip Dunker (MS Mechanical Engineering), Roger Quinn (Ph.D. Mechanical Engineering), William Lewinger (MS Electrical Engineering), and I have been developing a concept vehicle that utilizes the Whegs™ design and can perform these necessary procedures. Whegs™ uses “wheel-legs” that have multiple spokes but no rims so that they can roll like wheels and climb like legs. Having both these abilities makes a WhegsTM robot ideal for maneuvering through the moon’s rocky surface.

For this project, a four bar mechanism and scoop system were created that contains three of the four necessary positions for transporting regolith around on the moon’s surface. The fourth position, dumping, can be gained from other motions of the robot. The scoop holds 442 cm$^3$ of regolith and is considered satisfactory. Preliminary tests show that the torque necessary to move through all the positions is only .265 N-m, which is well within the range of two Hitec HSR-5990TG servos. The scoop is on the robot, and is fully operational. The robot can fill the scoop to over 95% capacity and carry the sand around without spilling. NASA will be testing the robot further in their facilities.

**Publications:** None yet.
Alexander Lee Rivera

**Status:** Senior, Biomedical Engineering

**Research Topic:** Micrometer Scale Guidance of Mesenchymal Stem Cells to Form Structurally Oriented Extracellular Matrix

**Advisor(s):** Harihara Baskaran, Ph.D.

**Biography:** Since high school, I held a strong interest in both math and science. Upon entering Case Western Reserve University, I decided that my passion for math and science would best fit a career in biomedical engineering; however, I also harbored an interest in medicine. As I progressed through biomedical related courses, I realized that the tissue engineering aspect of biomedical engineering best suited my passion for engineering and medicine. The ability to regenerate various tissues through the use of stem cells and tissue engineering techniques fascinated me and led me to this specialty sequence of biomedical engineering.

Currently, I am a senior at Case Western Reserve University and plan to earn my B.S. in Biomedical Engineering this spring. During my time at Case Western Reserve University, I have also volunteered at Rainbow Babies & Children’s Hospital, served as a dining hall representative, and have conducted research in the biomedical engineering field. Upon graduation, I plan to attend graduate school to obtain a Ph.D. in Biomedical Engineering.

**Abstract:** Osteoarthritis, a condition caused by the wearing of articular cartilage, can lead to severe joint pain and affects the quality of millions of lives in the U.S. Since native cartilage has poor repair capabilities, clinical measures must be taken to repair the worn cartilage. Current clinical techniques, however, only offer temporary relief from the symptoms and therefore, fail to provide a long-term solution. The search for a long-term solution has led to the field of tissue engineering. Using this approach, mesenchymal stem cells (MSCs) have been combined with biodegradable scaffolds to produce cartilage constructs in-vitro using necessary growth factors to induce chondrogenesis. Although these constructs are biochemically similar to articular cartilage, they lack the mechanical properties required for in-vivo use. These properties originate from the construct’s lack of structural organization at the micro level when compared to articular cartilage’s high organization. In this project, the first steps toward the creation of a structured cartilage construct will be taken.

To reach this goal, a phenomenon known as contact guidance will be used. In contact guidance, cells respond to the physical features of a substrate, which often alter cell functions such as matrix synthesis. For this project, microscale features will be formed on a collagen substrate to utilize contact guidance. We have hypothesized that these microscale channels will cause the differentiating MSCs to preferentially arrange themselves and deposit an oriented extracellular matrix on the microscale similar to native articular cartilage. To evaluate this hypothesis, channels will be formed on collagen-based membranes using a combination of microfabrication and collagen soft-lithography techniques. The channel patterns will be stabilized by crosslinking using 1-ethyl-3-(3-dimethylaminopropyl) carbodiimide hydrochloride (EDC) chemistry. Human MSCs will be seeded in these channels and initially tested for viability. The MSCs will be cultured for three weeks in these channels and will be exposed to TGF-β to induce chondrogenesis. Afterwards, the channels will be tested for chondrogenesis through histology and immunochemistry and for enhanced mechanical strength through mechanical testing.

**Publications:** None yet.
Amy J. Greenfield

Status: Senior, Adolescent to Young Adult Education (AYA), Chemistry
Advisor(s): Mr. William Jones

Biography: I am currently a senior at Cedarville University pursuing a degree in Adolescent/Young Adult Chemistry Education as well as a B.A. in Chemistry. I am from Dover, Pennsylvania, where I graduated from Dover Area High School in 2005. At Cedarville, I am the president of OTK, a pre-service science teacher organization. I am also the leader of a school program working with developmentally disabled adults and enjoy volunteering at a local nursing home. This semester I am student teaching at Greeneview High School in Jamestown, Ohio, teaching Chemistry and Physics. After graduation I intend to obtain a high school position teaching Chemistry in Ohio.

Abstract: The project that I am completing will allow students to investigate the phase change plateau in relation to the boiling point of water. In particular, it will explore the way that liquids change to vapor. It is designed for use in a junior level high school Chemistry classroom. This project will incorporate the NASA Educator’s Guide, “Is There Water on Mars?” into a unit of lessons discussing the properties of water. This activity will be used during this unit to encourage students to interact with the content knowledge on a real-life level. Working in groups, students will design and conduct an experiment to answer the question “How hot can you heat water?” The activity will conclude with a discussion which applies the observations from the experiment to issue of water on Mars. This discussion will use the results of the experiment to determine how water may have boiled off the surface of Mars.

Publications: None yet.
Abstract: Parkinson’s disease (PD) is one of the most common neurodegenerative disorders in the United States, and is characterized by dopaminergic neuron loss in the substantia nigra region of the pars compacta (Pendleton, Parvez, Sayed, and Hillman, 2002). This dopamine loss results in tremor, bradykinesia, and muscle rigidity (Coulom and Birman, 2004). However, the exact etiology of PD is unknown; although several genes have been implicated in early onset Parkinson’s, the majority of cases are sporadic (Chen, Lan, Roche, and Geiger, 2008). Current hypotheses for the cause of PD relate it to neuroinflammation, oxidative stress, and environmental factors (Gilgun-Sherki, Melamed and Offen, 2006).

Environmental factors, such as the pesticide and neurotoxin rotenone, have been shown to cause neurodegeneration in model organisms such as Drosophila melanogaster (Coulom and Birman, 2004). The fruit fly, with its tractable genome, accessible nervous system, and simple requirements, provides an opportune model organism to study the mechanisms of PD and evaluate the effects of various pharmacological agents on attenuating the symptoms of dopamine loss. In particular, caffeine and aspirin are two drugs that have been demonstrated to have a neuroprotective effect; this study will focus on their effect in lessening motor deficits in a rotenone-induced model of Parkinson’s in Drosophila. Furthermore, this study will continue to evaluate the effectiveness of rotenone in inducing parkinsonism in Drosophila, while laying the groundwork for future studies on the mechanisms of Parkinson’s disease.

Publications: None yet.
Biography: I am currently a Junior at Cedarville University. I will graduate in May of 2010 with a Bachelor of Arts in Mathematics Education and a Minor in Bible. I grew up in a rural area in southwest Pennsylvania, attending a public high school. It was here when I developed an interest in math because I had teachers who made math exciting and applicable to life. I am currently planning to do my student teaching overseas. After I graduate from Cedarville University, I plan to teach math in a public high school. I hope to continue my education by pursuing a Master’s in Education. My goal as a future teacher is to share my love for math to influence my students to come to an appreciation of math that is relevant to their lives.

Abstract: The project that I am doing is incorporating NASA material into an activity on geometry for 8th – 12th grade math class. This activity extends several days and begins with an informational search about the Orion spacecraft. After reading information over the spacecraft, students will then be divided into groups to estimate the total area of the vertical and horizontal cross-sections of the Orion crew module based on several diagrams. Students will use their knowledge of geometry to find an area estimate on the cross-sections, and compute their percent error from their findings. Then the students will estimate how many of the largest horizontal and vertical cross-sections of the Orion crew module would fit inside the classroom based on area. From the activity students will be able to decompose a geometric shape into smaller parts where they will apply proper area formulas to estimate the area of a complex geometric shape. After completing the activity, students will discuss various approaches used to complete the activity and summarize what they have learned.

Based on the NCTM standards, the activity will meet the expectation of visualizing three-dimensional objects and spaces from different perspectives and analyzing their cross-sections. Another expectation that will be met is recognizing and applying geometric ideas and relationships in areas outside the mathematics classroom, such as science and everyday life.

Publications: None yet.
Biography: My name is Jonathan Juhl, and I was born in California and moved to Michigan when I was 6 years old. My parents choose from the start to home school me and my 6 siblings, and I am very thankful for the impact that they have had on my life. Educationally, spiritually, and in every way, my parents have taught me to excel, be committed, and give 100%. They encouraged me that it didn’t matter what I ended up choosing as a career path, but that whatever I choose it should be something that I love doing. They challenged me to pursue my dreams. Since my early childhood I have always had a love for science, but it was not until high school that I decided that this was the direction that I would pursue once in college, and even beyond. I see scientific research as a vital part of overcoming the many obstacles which face our world today (energy needs, care for the environment, disaster prevention, cures for disease, etc.)

Abstract: My plans for researching atmospheric electricity thorough are closely tied to my involvement in Cedarville University’s High Altitude Balloon team. Our team has developed the capabilities to loft small payloads to altitudes of 90,000-100,000 feet via a high altitude helium-filled balloon. This will give us the ability to perform scientific research anywhere from ground level to near-space heights. Specifically the project idea is to develop a payload which will be able to measure the amount of electric charge in the atmosphere. There are many mysteries involved with understanding the nature of electric charges in our atmosphere. By performing this research, I hope to add to the knowledge which might lead to the answering of questions such as, what mechanism creates clear weather charge in the atmosphere. What force cause thunderclouds to separate into positive and negative charges? How does the presence of an electric field vary depending on location, atmospheric conditions, and time of year? Could the electricity in the atmosphere someday be harnessed practically for useful purposes? Before we can answer some of the big questions like these, there must be a more basic understanding of the presence and behavior of electric charge in the atmosphere. My goal is to research this concept in my project.

As a future physicist, the issue of the world’s rising energy needs is one that draws particular attention, as it is primarily the laws of physics that govern the ability to make and distribute power in useable forms. It is exciting to live in a day and age where the science community has a solid understanding of much of the guiding principles of physical laws and therefore we have the capabilities to explore new and revolutionary ways of tackling today’s issues, such as renewable energy. Another reason this area of atmospheric electric charge holds particular attention to me is I am also quite interested in space science and exploration. Study in these fields has shown us that there are instances of electrical phenomena which occur on other planets, such as Venus, Jupiter, and Saturn. Once we have a clearer understanding of electricity in our own atmosphere and ways to potentially harness this for useful means, there is the possibility that the same or similar techniques could be used to aid in the powering of human and robotic exploration of these and other planetary bodies.

Continued on the Next Page . . .
Jonathan F. Juhl (Continued)

Abstract: (Continued)
One particularly interesting and potentially dangerous occurrence on Mars is the possibility that there is lightning generated in powerful dust devils which sweep frequently across the deserts of the Red Planet. Knowing more about these and similar phenomena before we ever send humans to another planet like Mars is vital for human and electronic safety. The most important part of studying this issue is getting the chance to practice research first hand in an area that interests me and can someday potentially help others. It is an honor to be able to participate in this research through partnership with the Ohio Space Grant Consortium.

Publications: None yet.
Biography: I am currently a Senior Mechanical Engineering student at Cedarville University. During high school, I was involved in church events, played soccer for my school, played trumpet in the Cleveland Youth Wind Symphony, and became an Eagle Scout. After looking at several options, I decided to attend Cedarville University.

During my time at Cedarville University, I have discovered the many different aspects of mechanical engineering, and am most interested in the biological and medical aspects. After attaining my Bachelor's Degree in Mechanical Engineering I plan on attending graduate school to study Biomedical Engineering.

Abstract: Intramedullary nailing is the standard method used to fix femoral fractures. Unfortunately, these nails are very expensive, making them difficult to obtain by surgeons in developing countries. To address this problem my senior design team is working on a lower cost alternate intramedullary nail to be produced and supplied to a mission hospital in Kenya, Africa. My part of the project was to develop a finite element model to perform strength analysis on this nail design. From this model, I investigated the viscoelastic effects within the bone due to implantation and fixation of the intramedullary nail. This model will allow us to understand the effects of the implanted nail on bone stress and strain distributions that effect implant stability.

Publications:
Hallee M. Palmer

**Status:** Junior, Adolescent to Young Adult Education (AYA), Mathematics

**Research Topic:** Newton’s Second Law of Motion

**Advisor(s):** Sarah Gilchrist

**Biography:** I am currently in my junior year at Cedarville University. I will graduate in 2010 with a Bachelor of Science in Mathematics. Then in Fall of 2010, I plan on doing my student teaching overseas in China to complete my licensure for Secondary Mathematics Education. After graduation I would like to either teach high school math overseas or go to graduate school to pursue a Ph. D. in Mathematics. Ever since I learned to add when I was four, I have enjoyed learning about math. I love the logic and order that make up math. Some day I hope to be able to help my students have an appreciation for the beauty of math and its many practical everyday uses.

**Abstract:** This lesson will use the Newton car experiment from the Rocket Educators Guide. Each group of students will build one of these cars. The car is a block of wood with three dowels sticking out of the top. It is propelled by using rubber bands to launch a small container of varying weights off the back. By Newton’s second law of motion there has to be an equal and opposite reaction which causes the car to slide forward over a series of straws. The students will change several of the variables such as weight, force on the weight, distance between straws and number of rubber bands. They will then make several graphs of their findings. Once the points are graphed, they will fit a line to the points and find the equation of that line. They will then summarize the relationship between the variables and the distance traveled by the car. As a concluding assignment, they will be challenged to think about modifications they could make to the experiment to maximize the distance traveled. This lesson will integrate hands-on learning with the practical math skills of graphing and finding equations of lines.

**Publications:** None yet.

**Congressional District(s):** 12th

**Congressional Representative(s):** Patrick J. Tiberi
Mark A. Ratliff

**Status:** Senior, Adolescent to Young Adult Education (AYA), Mathematics

**Research Topic:** Modeling Orbits in the Solar System

**Advisor(s):** Dr. Darrin Frey

**Biography:** I am currently in my senior year of college at Cedarville University and will graduate in May with a B.A. in Integrated Mathematics Education and a minor in Bible. I am also currently doing my student teaching at London High School in London, Ohio. After graduation I plan on looking for a teaching position in an urban or lower income school district in Ohio and eventually I would like to earn a Master’s degree in Educational Administration. I also plan to coach football and/or basketball once I find a teaching position.

**Abstract:** The project that I am doing will incorporate NASA materials in order to model the orbital distances between planets. The purpose of this project is to show that most of the volume of the solar system is just made up of empty space, and thus it would be difficult to create a model that shows both the distances between and the sizes of the planets together. For this project I will first divide the class into 9 different groups and each group will be assigned a planet. Using data provided as well as their own independent research, the groups will prepare a short report describing the characteristics of that planet. After the reports have been presented, I will have the groups find the distances between their planet and the Sun. The class will then relocate to either the gym or an athletic field outside and with the Sun designated as the central point, the class will then measure the distance between the Sun and their planet using a knotted string and provided scale. Students will then be able to observe that the solar system is made up mostly empty space. I will also be sure to point out how the particular sizes of the planets compare to the sizes of the orbits, as well as any other important information about the solar system in regards to mathematics. Students will then be required to complete an assignment based on the activity.

**Publications:** None yet.
### Jarrod C. Steinmetz

**Status:** Senior, Adolescent to Young Adult Education (AYA), Mathematics  
**Research Topic:** Proportions and the Size of the Planets  
**Advisor(s):** Sarah Gilchrist

---

**Biography:** Presently I am in my senior year at Cedarville University. I will graduate in May with a B.A. in Integrated Mathematics Education. This semester, I will be completing my teaching at East Clinton High School. After graduation, my tentative plans are to hop a plane and teach in China for a while. I will be applying for a position to teach in one of any three schools in China where I will be teaching English and hopefully a little math as well. Depending on how the first year of this program goes, I may continue this for an unknown number of years. I do intend to return to the States at some point, where I intend to get a teaching job in the Dayton or Cincinnati area. It is my strong desire to teach high school mathematics. Upon my return, I also plan to continue my education by pursuing a Master's in Education.

**Abstract:** The project I will be working on consists of using NASA’s information on a unit concerning the size of celestial bodies. Using NASA’s specifics, students will be instructed to compare the size of the planets using proportions. Students will then be asked to compare the size of the earth to the other planets and find which celestial bodies are relatively the same sizes. As a second part to the project, students will be asked to find common household objects to represent the planets in a large scale mobile. Students will be split into groups and given a marble to represent the earth. Each group will be responsible for finding the size of the marble and finding one object to represent another planet. Things such as golf balls, tennis ball, basket balls, bowling balls, quarters, dimes, nickels, or any other relatively circular shape will suffice as a planet as long as its proportion to the marble matches that of earth to the planet it represents. As a conclusion, students will combine their objects and build a grand mobile in the classroom or gymnasium.

**Publications:** None yet.

---

<table>
<thead>
<tr>
<th>Congressional District(s):</th>
<th>2nd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congressional Representative(s):</td>
<td>Jean Schmidt</td>
</tr>
</tbody>
</table>
**Biography:** My interest and passion for science has its roots in my agricultural background. Since I was eight, I have been roaming the fields with my dog and raising cattle and swine. It was through these experiences that I developed a fascination for nature and a desire to understand all of its intricate processes. My inquisitive mind has since set out on a quest to better understand living things on a molecular level.

I am currently a junior at Cedarville University majoring in Molecular and Cellular Biology. My passion for science combined with a fascination of medicine and a burden to help those in need is leading me toward a career as a physician scientist. Upon graduation, I hope to pursue an M.D./Ph. D. and someday practice as a physician scientist serving an underserved people group in the U. S. or abroad.

My hobbies include basketball, running, weight training, hunting, and fishing. I still enjoy going back to the farm in north-central Ohio to help out when I can, and someday I would like to end up there, rocking in a chair on the back porch.

**Abstract:** Nociception is the physiological event in which a nociceptor (pain receptor) detects potentially harmful stimuli and transmits that information to the spinal cord and brain. This message is relayed through an intricate network of neurons, neurotransmitters, and receptors before reaching its final destination in the brain. Many of the neurotransmitters associated with nociception are also recognized as protozoan chemorepellents, which are substances that cause negative chemotaxis or avoidance behavior in protozoans. The study of these chemorepellents and their signaling pathways in protozoans may lead to valuable information regarding nociception in humans and possibly even to improvements upon our current methods of pain treatment.

One of these neurotransmitters that is also a chemorepellent is a peptide known as nociceptin. Nociceptin is the natural ligand of OFQ receptors in the brain, and is known to cause hyperalgesia or analgesia under different biological circumstances (Pan Z, Hirakawa N, Fields HL, 2000.). We are currently studying the signaling pathways used by the protozoan *Tetrahymena thermophila* to produce an avoidance response to nociceptin. We are using pharmacological agents to inhibit common signaling pathways in *Tetrahymena* and then monitoring any difference in the avoidance response of these *Tetrahymena* when exposed to nociceptin compared those not exposed to the blocking agent. Preliminary data suggests that nociceptin signals through a tyrosine-kinase receptor but does not utilize a pathway involving G-proteins.

**Publications:** None yet.
The Design and Analysis of a Fiber Glass Composite Fabricated by Vacuum Assisted Resin Transfer Molding

Abstract: The objective was to design, fabricate, test and compare results of material composites. The data was compared to reveal structural characteristics of the fabricated composites and possible improvements within its manufacturing process. Production analysis is performed to insure the highest quality parts and cost efficiency. The benefits of composite materials are its high strength to weight ratio, High creep resistance, High tensile strength at elevated temperatures and high toughness. The strength of the composite depends primarily on the amount, arrangement and type of fiber reinforcement in the resin. Typically, the higher the reinforcement content, the greater the strength. Fiber glass material was used as the reinforcement within the composite because it is most resistant to in plain shear stress, good resin penetration, and maximum fabric stability and firmness. The type of fiber glass used was an E-glass type, 45 degree directional weave about .0025" thick. A two part polymer resin was also used as the composite matrix. The Wet lay-up process involved impregnating six 6" x 6" fiber glass sheets with resin and placing the entire composite in a vacuum bag to insure a uniform bond between layers and good cohesiveness. The vacuum bagging consists of different layering of materials around the composite, each having an individual purpose to produce high quality results. The vacuum bag is attached to a pump that vacuumed all air out of the bagging at 15-18psi. While still in the vacuum, the composite was placed within a heated press machine for a 4 hour period at 250°F during the first 2 hours and ramped to 350°F for the remaining time. Once the completed composite cured, it was tested using a tensile tester to analyze it material characteristics. The yield strength, strain, elastic modulus, tensile strength, and ductility of the composites fabricated were calculated and data compared to also reveal the consistency and quality of the developing fabrication process. Results from data calculated were inconclusive. Further research includes implementing the actual resin transfer in place of the hand lay-up procedure, increasing production and calculating the standard deviation of data for a more reliable comparison of results.

Publications:
Biography: Joe was born into the loving family of Doug and Mary Betten and a younger sister, Laurina, in sunny southern California. His parents owned and operated an automotive repair shop throughout his childhood. This is what started his fascination with engineering.

He played football for four years, earned his Eagle Scout Rank from the Boy Scouts of America and graduated from San Gorgonio High School in 2005. Joe moved to Dayton, Ohio, to attend Central State University on a football scholarship. After one year he decided to put all of his time into engineering, and his education. He has been interning with the Research Laboratories at Wright-Patterson Air Force Base for three years and has spent a summer with Honda of America Manufacturing in Anna, Ohio. Joe graduates in May 2009, and expects to begin a career in industry soon after.

Abstract: Use microscopic evaluation and Electron Backscatter Detection along with mechanical strain tests to establish the use of Ultra Fine Grain Structure in Ti 6Al 4V to reduce the high temperatures of super plastic deformation during the blow forming with the ultimate goal of reducing energy and die material cost.

Publications: None yet.
### Central State University

#### Robyn L. Bradford

**Status:** Junior, Manufacturing Engineering  
**Research Topic:** Seeking a Procedure for the Reliable Crystallization of Proteins  
**Advisor(s):** Joe Ross, Ph.D.

**Biography:** As a licensed practical nurse (LPN), I am integrating my background as a practical nurse into an engineering career. Currently, I am a junior pursuing my Bachelor of Science Degree in Manufacturing Engineering at Central State University (CSU). I am an active member of my school’s chapters of the National Society of Black Engineers (NSBE) and the Society of Manufacturing Engineers (SME). I served as a senator for both organizations my sophomore year; and am now the vice-president for my NSBE chapter. After graduation, I plan to go to graduate school and ultimately earn my doctorate.

In addition to academics, I am an undergraduate research assistant for the Consortium Research Fellows Program. I work with the Air Force Research Lab (AFRL) in the Human Effectiveness Directorate at Wright-Patterson Air Force Base in Dayton, Ohio. I assist with research focusing on analyzing the performance and potential vulnerabilities of complex networks using mathematical and computer-based models.

For the summer of 2008, I interned with The Boeing Company in the Seattle, Washington. I worked in the Production Engineering Department for the Composite Manufacturing Center. As a manufacturing engineering intern, I supported the production of the vertical fin and the horizontal stabilizers for the 777. I assisted with work process improvements and learned about composite manufacturing and assembly techniques.

**Abstract:** This research was initiated when crystallization of albumin via published methods was unsuccessful after many trials even when highly purified samples of bovine albumin were used. It was concluded that there was no way to determine whether or not the albumin molecules were in a compact state. The belief here is that if the sizes of the albumin molecules form a wide distribution, the chance of crystallization is minimal.

The objective of this research is to investigate the effects of pH and protein concentration on the process of protein crystallization in an effort to develop a reliable, yet economical protocol for growing large, high-quality protein crystals. Albumin was selected as the test protein because of its ease of availability and low cost. The principle behind the approach is to discover how the average size of a protein changes when the concentration is varied at a fixed pH; and how the average size changes at a fixed concentration and varying pH. In most crystallization trials involving proteins, pH and concentration are very important variables. This experiment is expected to identify conditions where the average size of the protein is minimal. This is desirable because it is known that the more compact a protein is, the easier it is to crystallize.

In addition, lipoproteins such as albumin are characteristically very difficult to crystallize. In this investigation, we will attempt to systematically discover size changes based on analyzing plots of the data collected during this experiment. The intent is to establish experimentally that the more compact a protein is, the greater the chances of crystallization.

**Publications:** None yet.
Micheal Eric Burba

Status: Senior, Manufacturing Engineering

Research Topic: Implementing a Data Acquisition System to an Existing Creep Test Machine

Advisor(s): Dr. Mahmoud A. Abdallah and Dr. Alessandro R. Rengan

Biography: Micheal Eric Burba is currently a senior at Central State University majoring in Manufacturing Engineering. He was born in Jamestown, Ohio, and has lived in the small community his entire life. Eric excelled throughout his high school career but enjoyed mathematics, physics, and chemistry the most. His grandfather and high school chemistry teacher inspired him to become an engineer.

While attending CSU, Eric has been a member of the school tennis team, the Society of Manufacturing Engineers, and the National Society of Black Engineers. He also worked at the university tutoring students from all fields in the disciplines of Calculus, Chemistry, Computer Aided Design, and others. For the past two and a half years, he has been working as a student researcher at Wright-Patterson Air Force Base in the Materials Directorate in both sample preparation and fatigue analysis. He plans to continue working at WPAFB until graduation from CSU and then plans to pursue a masters in Material Science Engineering or working for the Department of Defense.

Abstract: The Manufacturing Engineering (MFE) Department at Central State University (CSU) has a creep machine in the materials laboratory that is not connected to the computer which renders data acquisition difficult. Since there is no data acquisition capabilities for the machine, the machine stands without being used and running a test for more than just moments would cause data collection to be tedious and the error in the data more prevalent. Most of the needed sensors for running a creep test are not available or not readily functioning. Because these sensors are not available, the department will need to purchase the materials. The creep machine also does not have an accurate or easy-to-read temperature display which makes it impossible to account for the temperature in the experiment. If this project were to be completed, the MFE department would have an operational creep test machine that could be used for research and as a learning aid.

This experiment deals with the implementation of the data acquisition software LabVIEW to the creep machine in the CSU materials testing laboratory. This lab will enable the students to understand the data acquisition process and also help improve the creep testing laboratory for future MFE experimentation. The physical properties that will be measured using the creep machine are temperature and displacement. For these tests, we will require not only the sensors to measure the data but also amplifiers to amplify the voltage signal so that it can be sensed by the National Instrument Hardware. The typical sensors for measuring temperature are Thermocouples, Resistance Temperature Detectors (RTDs), Thermistors and Integrated Circuit Sensors. However, for this lab we will be implementing thermocouples (k-type). The second phenomenon we will be measuring is the difference in position or the displacement. Transducers for this kind of test include Potentiometers, Linear Voltage Differential Transducers (LVDTs) and Optical Encoder. For the sake of this experiment we will be using LVDTs. More on the pros and cons of the use of both the thermocouple and the LVDT will be discussed later on in the report.

Publications: None yet.
Monica A. Porché

**Status:** Senior, Computer Science

**Research Topic:** A Scalable Parallel Algorithm for Simulating Heating and Cooling of Steady State Heat Flow Through a Metal Sheet

**Advisor(s):** Robert L. Marcus

**Biography:** I am currently a student at Central State University. As a Computer Science major, I would like to utilize my computer skills to become a Software Engineer or a Computer Networker. I’ve loved computers for quite a while now and being able to major in a field dealing with computers has changed my dreams into a reality. So far, I have participated in the Central State University’s High Performance Computing Program in May of 2006 and the Computation Science Workshop for Underrepresented Groups in January of 2007 at University of Southern California. Summer, 2007, I interned at Los Alamos National Laboratory, sponsored by the National Nuclear Security Administration and this past summer, I was fortunate to have interned at another national laboratory, Lawrence Livermore National Laboratory. Each program I’ve participated in has given me knowledge and has further assisted me in my goal of becoming a Computer Scientist.

**Abstract:** The objective of this research project is to develop a scalable parallel algorithm that simulates the control of steady-state heat flow through a rectangular metal sheet and implements it using MPI and C++ code. The simulation sets initial conditions of heat of 100°C applied to some edges and an ice bath of 0°C applied to the other edges. The parallel algorithm uses a row-wise decomposition of the metal sheet with various grid sizes: 100x100, 200x200 and higher. The rows are distributed to each task in the partition and the steady state condition is determined in parallel. Various numbers of tasks are used for each of the grid sizes so that the optimum speed-up and scalability of the algorithm can be determined.

The boundary conditions are raised or lowered and for each change steady-state heat flow is determined and the topology is analyzed. In past research it was determined that when the hot edges were lowered, relative maxima would occur along certain rows of the sheet. The location of these rows shall be identified and the temperature along the row will be cooled to determine if this method of cooling would provide a more efficient method of eliminating “hot spots” (locations where relative maxima initially occurred) on the metal sheet. A similar technique shall be applied to conditions when the cold (0°C) edges are heated and relative minima occurs. Heat shall be applied to rows where the relative minima occurs so that the relative minima row is eliminated in an efficient manner.

The project shall use MATLAB surface plots to display the various heat topologies and MATLAB two-dimensional function plots to display the speed-up graphs.

**Publications:** None yet.
Robert C. Charvat

**Status:** Junior, Aerospace Engineering  

**Research Topic:** Optimized Forest Fire Aerial Management Research and Software Development  

**Advisor(s):** Kelly Cohen, Ph.D.

**Biography:** I am presently a junior at the University of Cincinnati, majoring in Aerospace Engineering. I grew up outside of Cleveland in North Olmsted, Ohio, where my foundation and passion for engineering was laid. My first interest in Aerospace Engineering started as a child as I can remember when my father would bring home photos of aircraft from his work in which I would fascinate over and try to recreate with Lego’s. While in high school I was proficient in mathematics and science and thanks to a caring community received mentoring on possible careers. During my senior year in high school in the North Olmsted Sites Program I had the opportunity to volunteer two days a week at NASA Glenn Research Center where my interest in aerospace was confirmed.

Attending the University of Cincinnati I have participated in research opportunities to account for over 2 years of research experience. During my cooperative learning terms with General Electric Aviation I have had the opportunity to work on various development programs in various roles and locations. As a student research assistant I have worked in the Autonomous Systems Laboratory of the University of Cincinnati on a multifunctional self supporting robot as well as the UC Center Hill Facility in which I have worked on future Combustion technologies. As of Fall 2008 I have worked with Dr. Cohen of the University of Cincinnati in the subject area of aerospace controls. I am presently looking forward to a 2010 Bachelor’s graduation with an ultimate goal of a Ph.D.

**Abstract:** As humans we are at many times at the mercy of Mother Nature when dealing with natural disasters. A modern example of this has been the forest fires which struck California in 2007, burning an area the approximate size of Rhode Island. To continue the development of life saving techniques and technologies to support fighting forest fires, Dr. Kelly Cohen of the University of Cincinnati has created an initiative to bring experts in the fields of Aerospace, Fire Science, as well as researchers together to examine the way we fight fires. Specifics to this initiative include introducing new sensor technology, new control for fire prediction, and introducing new technologies such as UAVs to improve response times, aerial effectiveness, as well as provide a highly efficient and effective information infrastructure.

Continued on the Next Page . . .
Robert C. Charvat (Continued)

Abstract: (Continued)
My contribution has been to work with the fire prediction tool Farsite and Matlab to produce a test example of the potential capacities of a fire response system for aerial resources. In this test example I have implemented a Matlab code which calculates the most effective way to use aerial retardant drops to limit the expansion of a fire in no homogenous fueled environment. The test demonstrates that for rapidly progressing fires (expansion of over 100 acres per hour) a single airdrop can significantly slow the progress of a fire if the airdrop is made within a very short time of the fire's ignition. This is important as it is common practice for fire suppressant only to be dropped in coordination with ground forces, which limits the early response ability of aerial assets. These results if used in the field can change the way fires are fought early on with the potential ability to drop GPS guided suppressants based on Fire Models and UAV photos of without the use of ground forces. Specific challenges which are being overcome include integrating Farsite 2D hourly fire models into Matlab to provide fire expansion data and programming logical fire fighting models to best use aircraft to battle fires as well as managing multiple aerial assets among multiple burning locations. Early Conclusions can be summarized well with the following quote "In many cases it can take days to deploy ground forces to an area to begin battling a fire, if this technology can be implemented in the field it is expected it will allow for the capacity to battle a fire if not hours after its ignition but in minutes. As can be imagined, an improvement of that degree can be described as life changing for those counting cost of the fire as well as those fleeing from the fire itself."

Publications: None yet.
Adam R. Gerlach

Status: Master's 1, Aerospace Engineering

Research Topic: Performance Enhancements of 3D Pose Estimation Utilizing the Graphics Processing Unit

Advisor(s): Dr. Bruce Walker and Dr. Albert Bosse

Biography: My interests in engineering were developed at a very young age. My father owned a machine shop that did high production machining for the automotive industry along with custom tool and die development. I spent countless hours watching him solve real-world engineering problems. When it came time for me to make decisions on pursuing a college education, I decided that I wanted to work at the cutting edge of technology and thought a degree in Aerospace Engineering at the University of Cincinnati was the best avenue to reach that goal.

While an undergraduate student at the University of Cincinnati, I completed the cooperative education program by working as a spacecraft propulsion engineer at the Naval Research Laboratory (NRL) in Washington DC. At the NRL, I had the unique opportunity to contribute to the design, development, analysis, build, test, and flight operations of the propulsion system of a new experimental upper stage for the MiTEx program. As a senior, three fellow classmates and I were selected by NASA to perform an autonomous rendezvous and capture robotics experiment (Optical Network for µ-gravity Rendezvous of Independent Systems, ONµRIS) on NASA’s ‘Weightless Wonder’ (aka the ‘Vomit Comet’) as part of the NASA Microgravity University Program. The work performed on that experiment has fueled my interests in my current graduate research at the University of Cincinnati.

Abstract: The Defense Research Projects Agency (DARPA) is currently developing a new class of servicer spacecraft to perform autonomous rendezvous and docking of target spacecraft without the requirement for detailed prior knowledge of the target spacecraft’s geometry. To be successful, these spacecraft require technical advances in machine vision, particularly real-time target position and orientation (POSE) determination. This project looks to augment an established POSE estimation algorithm to utilize non-traditional computer hardware in order to realize real-time algorithm performance. Spin-Images, the POSE estimation algorithm of interest, is a highly parallelizable algorithm that could benefit from the massively parallel architecture of the modern Graphics Processing Unit (GPU).

Leveraging the benefits of the GPU and the parallelizability of the Spin-Image algorithm, significant improvement in speed, accuracy, cost, and scalability are expected. It is also anticipated that this system will provide improvements to applications other than Autonomous Rendezvous & Capture and even outside the traditional aerospace field. Increases in algorithm performance could make visual POSE estimation feasible for patient tracking in autonomous robotic surgeries, medical image registration, and three-dimensional scene reconstruction.

Publications:
### Biography

Born and raised in Cincinnati, I quickly fell in love with what the city had to offer me, both in terms of education and potential careers. I knew from an early age that I had a passion for math and the sciences, thrived on problem solving, and eagerly sought after new challenges. Engineering seemed to be the only choice for my college pursuits, and the University of Cincinnati with its renowned Co-op program was an easy decision. I am currently in my third year of a five-year ACCEND program that combines both a Bachelor's and Master's Degree with the Co-op experience. To date, I have completed three Co-op rotations at General Electric Aviation in Cincinnati: Installations – Engine Build Up, Rotating Parts – Mechanical Systems, and CF6 Product Support Engineering. During my time at GE I have been able to experience numerous aspects of the engineering process from design to production and even servicing engines in the field. After graduating with my B.S./M.S. Degrees, I will most likely pursue a career with GE Aviation where I plan to also work on my Doctorate.

During academic quarters, I am involved with several different organizations such as the Society of Women Engineers (SWE), the American Institute of Aeronautics and Astronautics (AIAA), and Campus Crusade for Christ (CRU). This Computational Fluid Dynamics (CFD) project will be my first experience in research. It is my hope that this experience will not only help me narrow down a topic for my graduate thesis paper, but will also build a strong foundation for a career working in research and design for military and commercial aircraft engines.

### Abstract

My current research project focuses on the area of Computational Fluid Dynamics, more specifically the software program VSAERO. Recognized as the most widely used program in its class, VSAERO is a three-dimensional lifting panel code that uses single singularities on each surface panel. The program stems from an effort within Aeronautical science to develop the ability to routinely simulate complex three-dimension fluid flow around a complete airplane. Its ability to calculate both internal and external flows, as well as non-uniform inflow and body rotation (in a relatively short amount of time), makes VSAERO not only applicable, but extremely valuable to fluid flow problems throughout the entire realm of Aerospace and Aeronautical engineering.

The first phase of my project involves using the software to model the flow around known aerodynamic bodies, gradually increasing in difficulty until I develop a sound understanding of the program’s design and capabilities. By using a body that has already been highly analyzed to various degrees of accuracy, I can easily validate my results by comparing them to published results. This provides the important value of knowing that I am developing a working understanding of the software and can therefore have more confidence in my future analysis.

For the second phase of my project I hope to develop the first edition of a working document that will enable future undergraduate students to more efficiently learn and use the VSAERO program. This “student manual” will be able to provide an overview of the theory behind the calculations, the assumptions that are being made, and the applications of the software, all at a level understandable to undergraduate students. As a working document, each future user can also include their lessons learned, best practices, and other useful insight they have obtained during their work. Such a resource will most likely become invaluable to smoothing the learning curve for future VSAERO undergraduate research programs.

### Publications

None yet.

### Congressional District(s):

2nd

### Congressional Representative(s):

Jean Schmidt
Robert D. Knapke

**Status:** Senior, Aerospace Engineering  

**Research Topic:** Counter-Rotating Aspirated Compressor

**Advisor(s):** Mark G. Turner, Ph.D.

**Biography:** I am currently a Senior Aerospace Engineering student at the University of Cincinnati. Ever since grade school I have had an interest in math and science. During high school, I realized that I enjoyed Physics most of all and found Aerospace Engineering to be a good combination of interesting Physics and difficult math problem solving. Due to the co-op program offered, I decided to attend the University of Cincinnati. I thought that this opportunity would allow me to decide which area of my major I enjoyed most before leaving college.

Throughout my first few co-op quarters, I realized that I enjoyed the research aspect of engineering. More specifically, I began to work at the Gas Turbine Simulation Laboratory (GTSL) and found that I enjoyed Computational Fluid Dynamics (CFD). I had already had an interest in the fluids aspect of the aerospace field and to my surprise; I discovered that I enjoyed programming as well. The CFD research I took part in at GTSL ended up being a very good fit for my interests. Currently, I am in a program to obtain my Bachelor's and Master's Degrees and I plan on pursuing my Doctorate all in the area of Aerospace Engineering with a focus on fluid dynamics. The Counter-Rotating Aspirated Compressor project I am working on has given me great insight into my area of focus.

**Abstract:** The research of the Counter-Rotating Aspirated Compressor (CRAC) includes a time accurate simulation using the flow solver TURBO. The CRAC design consists of an inlet guide vane (IGV) and two counter-rotating rotors, the second of which includes aspiration (or suction). The purpose of the counter rotating rotors is to eliminate the need for a stator in between the two rotors, which is necessary in conventional compressor stages. Removing this stator blade row allows for lower engine weight. The suction in the second rotor blade row removes low momentum boundary layer fluid, which reduces separation. Also, the positioning of the aspiration slot at a location of nearly separated flow allows for the same effect using less suction.

The CRAC design experimental testing was conducted in the Massachusetts Institute of Technology (MIT) Gas Turbine Laboratory. This experiment was conducted using a blowdown test facility using a mixture of CO\textsubscript{2} and Argon as the working fluid, which reduces the physical stresses on the test rig while maintaining the same ratio of specific heats ($\gamma$) as air. The data collected from the MIT testing was used for initialization conditions and to compare the simulation results near the downstream data collection of the MIT testing.

The CFD simulations were conducted using TURBO which is a 3D, viscous, unsteady RANS solver. The simulation conducted for this research did not include the IGV blade row in order to reduce the time of computation. Instead, a separate simulation of the IGV and rotor 1 was conducted to provide inlet conditions into the first rotor to simulate the effect of the IGV. Simulations for both aspiration and non-aspiration were run at the University of Cincinnati's Center Hill Gas Turbine Simulation Laboratory (GTSL) on 52 Pentium Core2Duo 2.4GHz processors for each case. The two cases will be compared between themselves and with the MIT experimental data.

Further simulations have been conducted including grid refinement studies and simulations with different boundary conditions. Also, procedures have been created for reaching a converged solution in half of the time previously taken.

**Publications:**
Maisha M. Murry

**Status:** Doctoral - 2, Radiological Engineering

**Research Topic:** Dissolution Rate of Respirable Airborne Particles of JSC-1 Lunar Mare Regolith Simulant, and Mount St. Helen Volcanic Ash in Lung Simulant Fluid and Deionized Water

**Advisor(s):** Dr. Henry Spitz

**Biography:** I am originally from Harrisburg, PA. I obtained a Bachelor of Science Degree in Chemistry from Tuskegee University in 2004. During my time at Tuskegee University, I had an opportunity to intern at Ernest Orlando Lawrence Berkeley National Laboratory (LBL) twice, once with the High Energy Physic group at the 88-Inch Cyclotron working toward producing medium-lifetime radioactive beams to test the limits and feasibilities of working with them. My second intern at the laboratory was with the Indoor Environment Department helping develop a portable sampler for Environmental Tobacco Smoke to access inhalation exposure. During my junior year at Tuskegee University I participated in a summer enrichment program at the University of Cincinnati in their Nuclear and Radiological Engineering program which introduced me to graduate research and career opportunities in the nuclear field.

My participation in the University of Cincinnati’s summer enrichment program lead me to pursue and obtain a Master of Science in Health Physics from the University of Cincinnati in 2006. For my Master's project I developed a new method involving a NaO₂/NaCO₃ Fusion to completely dissolve a polyurethane bases lung tissue substitute to confirm the expected content of radioactive material. While working towards my Master's I interned with the National Institute for Occupational Safety and Health (NIOSH) in the Health Related Energy Research Branch – Exposure Assessment group were I assisted in compiling case study information on workers who were potentially exposed to radioactive material while on the job. I also have interned at Idaho National laboratory (INL) in the Nuclear Energy Aqueous Separations and Radiochemistry Department were I electroplated uranium to produce targets for studying neutron cross sections. After the completion of my Master's I participated in the Science and Technology Enhancement Program fellowship in the Cincinnati Public schools in which I designed, developed, and implemented hands-on activities and technology driven inquiry based projects that related to students community issues as vehicles to authentically teach math, science, engineering and technology skills.

I am currently working on toward a Ph.D. in Radiological Engineering at the University of Cincinnati. During the process of working towards my Ph.D. I have completed two summer internships with the United States Nuclear Regulatory Commission (NRC) in the Division of Nuclear Material Safety within the Decommissioning Branch. I worked with a team of Health Physicist by means of accompanying certified NCR inspectors on inspections of licensees, and I also worked towards completing the basic inspector training.

Following the completion of my Ph.D. I look forward to pursuing a career with the federal government as a scientist/engineer. In addition I would also like to continue to work closely with inner-city youth to get more students involved in math and science.

Continued on the Next Page . . .
Abstract: The concentrations of respirable airborne particles in the urban environment and lunar environment maybe associated with an increased incidence of disease, although the mechanisms linking fine particle exposure to increased disease are not well understood. The exchange of oxygen in the lung is essential for sustaining life and the dissolution rates of airborne particulate matter is a very important parameter in determining in vitro clearance rates of respirable airborne particles in the lung. These risks are apparent on earth and in the lunar environment. In the lunar environment astronauts are most susceptible to lunar dust exposure upon return to the space shuttle during the removal of their space suit. When removing their space suit the lunar dust that has adhered to their suit is momentarily re-suspended at which time the astronauts are subjected to inhalation exposure of lunar dust.

The respirable fraction of JSC-1A Lunar Mare Regolith Simulant will be analyzed to determine the elemental concentration of the particles contained on the filters. The filters will then be irradiated in a Cobolt-60 irradiate to simulate the radiation exposure rate on the lunar surface. The irradiated filters would then be submersed in lung simulant fluid for predetermined periods of time (e.g., 1 hr., 8hr., 24 hr., …) to determine what fraction of the initial concentration of particles has dissolved. An aliquot of the simulated fluid would be analyzed to determine the concentration of particles that solubilized into the solution. After the dissolution testing, the filter would be dried and reanalyzed to determine the amount of the residual concentration of particles that remain on the filter. The same methodology would be implemented using deionized water. The Mount St. Helen volcanic ash would be treated in the same manner as the JSC-1A Lunar Mare Regolith stimulant. The dissolution rates of the respirable particles of Lunar Mare Regolith simulant JSC-1A, and Mount St. Helen volcanic ash would be determined. Particles that are rapidly soluble in the lung simulant fluid have the potential for entering the blood stream and being distributed to other organs and tissue in the body. Insoluble particles may remain in the lungs where they have the potential to impact lung function or may be removed via the gastrointestinal tract where they may dissolve, enter the blood stream and become distributed in other organs and tissue of the body.

Publications:
Status: Senior, Aerospace Engineering
Research Topic: A Study of the AEROFLO Computational Fluid Dynamics Software and Separated Flow inside an LPT Cascade
Advisor(s): Dr. K. N. Ghia

Biography: I am currently a senior in Aerospace Engineering at the University of Cincinnati. I graduated as Valedictorian from Kalida High School, Kalida, Ohio, and chose to attend the University of Cincinnati not only for its strong aerospace engineering curriculum, but also for its robust cooperative education program that has proved invaluable to my academic experience. My most recent co-op rotation was spent in the Space Propulsion Branch at the NASA Glenn Research Center, where I plan to return upon completion of graduate studies. Currently, I am the Vice President of the UC American Institute of Aeronautics and Astronautics (AIAA), the Treasurer of the Ohio Beta Chapter of Tau Beta Pi, and the Secretary of the UC Chapter of the Students for the Exploration and Development of Space (SEDS). I am also involved in various community service activities, such as the volunteer program at the NASA Glenn Research Center Visitor’s Center and the Clifton Community “Into the Streets” program.

Abstract: Modern gas turbine engines are optimized for the flight conditions experienced during take-off and landing. At these low altitudes, the flow through the engine is at a high Reynolds number and the resulting turbulent flow in the low-pressure turbine (LPT) deters separation on the turbine blades. However, the majority of the flight profile is spent under cruise conditions, where a decreased atmospheric density results in lower Reynolds number flows. At such low Reynolds numbers, the flow through the LPT tends to be transitional. As such, when the momentum of the flow is unable to overcome viscous forces and the adverse pressure gradients experienced on the suction sides of the LPT blades, the flow separates. The separated flow first becomes unsteady and subsequently undergoes transition to turbulent flow. Oftentimes, this energized flow reattaches to the turbine blade, resulting in a separation bubble on the suction surface. These separation bubbles are the cause of great pressure losses during the majority of the turbine engine’s operation. Thus, much effort has been focused on increasing the efficiency of the LPT by delaying or suppressing this separated flow.

The objective of this research project is to study the separated flow inside an LPT cascade composed of Pratt & Whitney Pak-B blades. AEROFLO, which is the commercial software version of the FDL3DI computational fluid dynamics research code developed at the Air Force Research Laboratory at Wright-Patterson AFB, is used to analyze the three-dimensional flow inside the LPT cascade at Reynolds numbers < 50,000. The results of this analysis are compared to corresponding experimental data in order to validate the current usage of this software. In addition, some flow control strategies are also investigated to quantify the suppression of the prevailing separated flow.

Publications: None yet.

Congressional District(s): 5th
Congressional Representative(s): Robert E. Latta
Biography: I am a Senior Mechanical Engineering student at Cleveland State University. I have participated in the Lewis Educational and Collaborative Internship Program (LERCIP) for three summers. During the internships I acquired an interest in electrical engineering. I plan on getting my Bachelor’s Degree in Mechanical Engineering followed by a Master’s in Electrical Engineering from Cleveland State. I am a member of Cleveland State’s Honors Program which has given me the opportunity to learn more from hands projects in addition to the classes. My experiences in the internships, classroom and this project have given me a broad prospective of the many fields in engineering.

Abstract: My research project involves a novel kind of sensor built using organic material. The project utilizes a relationship between mechanical and electrical properties. Piezoelectric materials produce electrical charges when mechanical stresses are applied. For this project, I will be doing some experiments on a piezoelectric biopolymer. This material will be used as a strain sensor for biomedical applications. The process for preparing the material involves a silver plating process which turns the material into a small capacitor. When the material is stressed, the strain can be measured with the value of the capacitance. The experiments will be done with materials that have different concentrations of “whiskers” that are used to give the material more strength. The sensor will then be mounted to a beam along with a traditional strain sensor to compare the measurements. The accuracy of the measurements can then be compared to that of a traditional resistance type strain sensor.

Publications: None yet.
Status: Senior, Middle Childhood Education, Science and Mathematics

Research Topic: Using Proportions and Ratios to Create a Model of the Solar System

Advisor(s): Dr. Patrick W. Wachira

Biography: I am currently enrolled at Cleveland State University. I am in my senior year and will be graduating in May 2009. I will graduate with a degree in Middle Childhood Education with concentrations in Mathematics and Science. Currently, I am doing my student teaching at Cleveland School of the Arts teaching 7th grade science and Algebra. After graduation, I plan to teach middle school math or science in an urban district. I plan to obtain my Master’s in Mathematics within five years of graduating.

Abstract: The project I am doing is a cross curriculum unit incorporating math, space science and NASA materials. This unit, which will take several days, will explore our solar system. Students will work in groups learning facts about our solar system: planet sizes, atmospheric conditions, distance from the sun, etc. They will use ratio and proportions, information gained through their research, as well as NASA materials to create a scale model of our solar system.

Publications: None yet.

Congressional District(s): 11th
Congressional Representative(s): Marcia L. Fudge
Aimee Lee McConnell

**Status:** Junior, Electrical Engineering

**Research Topic:** The Theory and State Feedback Control of Magnetic Bearings

**Advisor(s):** Dr. Charles Alexander

**Biography:** My name is Aimee McConnell, and I am a junior at Cleveland State University majoring in electrical engineering. For as long as I can remember, I’ve wanted to be an engineer. What initially sparked my interest in engineering was the NASA Program. I’ve always been fascinated by the evolution of technology and how many accomplishments we have achieved in science. Ever since I was a kid, I have strived to combine my two passions: the NASA Program and electrical engineering. For the past four summers, I’ve achieved my goals by participating in internships and co-ops at NASA Glenn Research Center (GRC) which have been extremely beneficial to me. For the remainder of my college education, I plan to continue to explore engineering through hands-on experience with undergraduate research and various internships.

I also plan to continue to be involved with school activities. Currently, I am involved in activities such as acting as vice-president of the Society of Women Engineers, participating as a member of the Institute of Electrical and Electronic Engineers, and participating as a Fenn Ambassador for CSU’s Fenn College of Engineering. I am also a member of the Honors Program at CSU.

In the future, I hope to work at NASA GRC as an electrical engineer where I can make a positive impact in the fields of research and engineering.

**Abstract:** A magnetic bearing is a device which supports a rotating assembly, such as a rotor and shaft, by means of a magnetic levitation. There are two types of magnetic bearings: passive and active. Passive magnetic bearings are created by using permanent magnets. Active magnetic bearings, AMB, are created by the use of electromagnets. This paper will mainly discuss the theory and control with position feedback of the AMB, specifically state feedback and stability.

In order to analyze and design a control system for the magnetic bearing, it is necessary to start by examining the nonlinear system from fundamental principles in theory of physics, mechanics, and electromagnetism. Once the nonlinear system is derived, it is important to linearize the system of the magnetic bearing by applying the Jacobian transformation, in which state-space form is necessary. The linearization step is important in order to design a control system for the magnetic bearing model. These steps will be shown in detail in this discussion.

**Publications:** None yet.
Biography: I am in my senior year at Cleveland State University, and in May will graduate with a degree in Chemical Engineering and a minor in Chemistry. I was born on January 5th, 1987, in St. Joseph, Michigan, to Gayle and Larry Snell. I grew up in Clarks Green, Pennsylvania, with an older brother, Michael Snell. I attended Abington Heights High School where I thrived in the fields of math and science. As well as being proficient in the classroom, I continued to excel in varsity athletics, including soccer and baseball. In addition, I was an All-State violist in the orchestra.

After graduating high school with honors, I came to Cleveland State University for further enrichment in my studies. Cleveland State has allowed me many opportunities including membership in several honor societies such as the Tau Beta Pi Engineering Honors Fraternity and Golden Key International Honors Society. As in high school, I not only flourish in academics, but am also a captain of Cleveland State University’s Division I NCAA fencing team and am member of the Cleveland State University Orchestra. I find that being busy allows one to develop time management skills. In my excess time, I like to devote myself to certain projects, as seen in my research on thermal characterization of thin film deposition processes, for further enrichment and experience in my field of study.

As a freshman, my major and honors advisor, Dr. Gatica, was very kind to me and took me under his wing. I recently enrolled in the accelerated master’s program for chemical engineering, which allows me to take graduate courses during my undergrad career. After graduating in May, I will continue my education for an additional year and will obtain my Master’s of Chemical Engineering in May, 2010.

Abstract: Corrosion resistance and energy efficiency have long been driving forces to substitute low-carbon steels by more advanced materials. In the automotive and aerospace industries, structural materials commonly require a complex sequence for processing. Indeed, most structural materials require machining and the application of surface layers before ultimate processing. Some coatings might be required to be resistant to corrosion or act as chemically resistant coatings. One step that has proven to be an engineering challenge is surface pre-treatment process. With newfound environmentally friendly processes, chromates-based technology traditionally used as surface pre-treatment processes, have become a target for elimination by the United States Environmental Protection Agency (EPA).

My research project at CSU is aimed to characterize solutions of aryl phosphates and inter-metallic acetates, a proven efficient metal-working fluid, as precursors for conversion and protective coatings. With a new state-of-the-art Differential Scanning Calorimeter, I first compared a set of previous CSU coating characterization experiments to those performed using the new unit. The DSC cell enabled us to characterize deposition reactions, to correlate thermal properties, and to estimate kinetic parameters. Kinetic analysis of these experimental data yields a phenomenological model of the coating process, which can later be used for design and scale-up of the coating process. With the assistance of a sophisticated finite-element modeling environment, COMSOLTM Multiphysics, we anticipate elucidating the complex interaction between transport phenomena and chemical kinetics occurring in deposition environments. We envision comparing these predictions for small and medium-scale deposition experiments.

Publications: None yet.
**Biography:**

My name is Brittany Studmire, and I am an Ohio Space Grant Recipient at Cleveland State University where I am currently a sophomore honor's student majoring in chemical engineering. My passions include learning and music. With my chemical engineering degree, I hope to one day help impoverished nations grow to a point of sustainability and independency through innovations in green technologies focusing specifically in the areas pertaining to clean water.

Over the past two years, I have been awarded the opportunity of interning at NASA Glenn Research Center through its LERCIP program. Because of that program, I was able to intern under an expert in the field of storm water management as it pertains to the environment. With this knowledge I have gained, I hope to make a significant difference in this world.

**Abstract:**

It is the goal of NASA Glenn Research Center to ensure the safety of all its employees. In this sense, it was my job to assist the Safety, Health, and Environmental Division in pursuing this goal by working closely with the Environmental Branch to ensure safe soil, safe air, safe water, and a safe work environment.

My tasks included increasing awareness of the need to protect our waters by actively informing Glenn employees of this through informational posters and pamphlets I created. Such topics covered include oil pollution, detergent pollution, storm drain markings, proper fertilizer usage and storage, and good housekeeping measures.

In addition to that, I also did some research on various topics that if implemented, could benefit NASA Glenn tremendously and ensure our place as leaders in green technologies and practices. These areas included porous pavements; plastics, recycling, and reusability; silt fencing; rock salt alternatives; geothermal heating; and grey water use.

Overall, these may seem like small things, but they are important projects nonetheless that bring us closer to our goal of creating a safe, healthy environment that is sustainable for future generations.

**Publications:** None yet.
Biography: My educational path has been non-traditional, yet I approach my studies with no less vigor. After a 27-year hiatus I returned to Cleveland State University in the Spring of 2005. Prior to my return, I raised 5 children and owned two manufacturing businesses. My particular area of expertise was in the manufacture of orthopedic bone screws. Most of these medical components were made on computer-numerically controlled machines. I have much practical experience and some of that has transferred to my studies. I am excited about my research and hope to pursue further studies in chemical engineering.

Abstract: About 1,000 commodity chemicals are produced yearly in the chemical industry. The complete thermodynamic properties of perhaps 15 of those chemicals have been tabulated. My research involves the determination of 18 thermodynamic properties of the benzene molecule over a range of temperatures and pressures ranging to 1000 bar. The planar molecule is modeled as a Lennard-Jones system. A sophisticated modification of the Verlet algorithm provides Monte-Carlo simulation of molecular interactions. The algorithm calculates thermodynamic properties and the associated errors simultaneously. Results obtained will provide an equation-of-state for benzene. The next step in the research will be to extend the simulation into the area of other symmetric ring type molecules.

Publications: None yet.
**Research Topic:** Reduction of Work Site Injuries through Environmental Resources Management

**Advisor(s):** Professor Jeffery M. Woodson

**Abstract:** I have found through my years of working in the construction field that safety has always played a major role in the completion of a project. In recent weeks it seems that there have been a number of fatal accidents. I will be looking at possible reasons for the increase of work site injuries. The goal of this research will be to develop strategies toward solving this issue.

**Publications:** None yet.
Biography: I am beginning my second year at Columbus State Community College in the Mechanical Engineering Technology Program. I became interested in this program two and a half years ago when I took a job at a local manufacturing company. As a part of the hiring process, I was sent to take a machine tools class at Columbus State. The instructor encouraged me to take a closer look at the Associate Degree Program. After several months of consideration I enrolled. I am certainly a non-traditional student as I had tried college several times since I finished high school in 1995. I have, over the years had many different jobs, none of which I was interested in pursuing as a career. I am planning to pursue a Bachelor's Degree after I have finished my Associate's Degree, but I am unsure as of yet whether it will be in engineering or engineering management. My interests are mainly in computer-aided design, and robotics.

Abstract: Heat treating steel is done to achieve different characteristics of hardness for specific uses in industry. By varying the temperature, heat soak times, and rates of cooling (quenching) we are hoping to either harden by forming martensite, or to soften via re-crystallization of work hardened grains, also known as annealing. By heat treating, the properties of the steel can be altered to produce specific a hardness of steel which can be used in applications where the normal hardness characteristics of the steel would not be sufficient to withstand the stresses it might be subjected to.

Four different types of steel will be subjected a heating cycle, one group of samples will be allowed to cool at room temperature, one group will be allowed to cool in the heating oven at a slower rate, and one will be quickly quenched in water. The samples will then be tensile tested in a tensile tester, and hardness tested using a Charpy hardness tester. The results will be analyzed and compared to a control group. The control group will consist of all four types of steel and will not be subjected to any heating or cooling, but will be tested the same as all of the other samples.

Publications: None yet.
Kevin E. Fisher

Status: Senior, Mechanical Engineering

Research Topic: Fluid Dynamics of a Plunging Airfoil

Advisor(s): Aaron Altman, Ph.D.

Biography: I am a Senior Mechanical Engineer at the University of Dayton. I was born and grew up in Columbus, Ohio. During high school I developed a strong attraction to math and science, but it was not until my senior year physics class in high school that I realized mechanical engineering was the right fit for me. Later that year, I decided that the University of Dayton was the perfect fit for me to continue my studies.

The University of Dayton has given me many opportunities to succeed. My professors have been very helpful; they are always willing to lend a hand or go out of their way to help me out. I have been involved in the New Engineering Program, a club on campus which promotes service and real world experiences for engineers. I am also very involved in the ETHOS program, which sends students around the world to work on appropriate technologies in third world countries. In the Summer of 2008, I spent two weeks in Nicaragua working on solar cookers for a local village. In May, 2009, I plan to go on a ten-week trip to Guatemala to work on water filters for another village community. This combination of service and engineering has greatly shaped who I am and what I wish to do with my future career.

Abstract: Fluid dynamics is the study of the effect of fluid motion across a specified object. The purpose of this project is to observe the effects of fluid flow on a plunging airfoil design in a water tunnel. This project was conducted at a water tunnel located in Wright Patterson Air Force Base. A two dimensional particle image was taken of the fluid surrounding the airfoil at different stages of its plunge. The airfoil was set in motion by two mechanical arms which control the airfoil’s angle, as well as vertical position. The images were analyzed to observe the velocity and vorticity fields in the fluid. The final goal of the project was to measure the forces placed on the airfoil to determine what kind of lift forces would be placed on a moving wing.

Publications: None yet.

Congressional District(s): 15th
Congressional Representative(s): Mary Jo Kilroy
Biography: I am currently in my junior year at the University of Dayton (UD), majoring in Mechanical Engineering. Growing up I have always been interested in how objects in our world work and how they could be designed differently to possible make them work better. I first became interested in engineering through a program at my high school, which led me to the UD. While at the UD I have become particularly interested in alternative, renewable, and clean energy, and am concentrating my degree in the field.

In the past couple of years at UD I have worked on a variety of research projects related to alternative energy, including thermoelectric devices, solar panels, and geothermal systems design. During my time at UD I have also become involved in numerous organizations including the Society of Hispanic Professional Engineers, Minority Engineering Program, and Epsilon Delta Tau, a social engineering fraternity, which I am the Vice President and Scholarship Director of. I have also been involved in the co-op program at UD, in which I have completed two co-op rotations at GE Aviation in Evansdale, Ohio. I worked in both the Combustor Design Engineering Department and the Marine and Industrial Engine Department, working alongside design engineers. I am currently trying to get an internship at the US Department of Energy Renewable Energy Research Lab over the summer, which I think will suit my interest well. Upon graduation I would either like to work in a renewable energy research lab or perhaps start my own company with alternative energy solutions. I also want to continue my education, and plan to pursue at least a Master’s Degree in a Mechanical Engineering field.

Abstract: Vertical Axis Wind Turbines have been introduced commercially, but have never really been able to survive in the market. Their main downfall is their inefficiency, particularly when compared to Horizontal Axis Wind Turbines, which most of us are familiar with. Their advantages, however, are that they require a smaller wind speed to start spinning and generating electricity and they can capture wind coming in from any direction. One model, the Savonius, holds great potential in the market, because it is simple and cheap to make. If the efficiency of these turbines could be increased, they could have a future spot in the residential market to provide power for our homes.

A wind tunnel will be used to study various model designs of Vertical Axis Wind Turbines. One goal will be to design my own model and conduct testing in the wind tunnel. The tests will focus on how fast the turbine is rotating as a function of wind speed and the efficiency of the turbine. I will compare my own model to similar designs already out in the market place. An overall goal also is to develop a greater understanding of how to test the models and scaling the calculations up to a real world design.

Publications: None yet.
Andrew P. Huelsman

Status: Senior, Mechanical Engineering
Research Topic: Residential Energy Use

Advisor(s): Dr. Robert Brecha and Dr. Kelly Kissock

Biography: I grew up in St. Henry, Ohio, which is farming community located in Mercer County. I come from a family of eight with four brothers and a sister. Throughout my K-12 education I participated in many sports including basketball, baseball, and football. I won state championships in baseball my sophomore year and basketball my junior year. My participation in sports taught me the discipline and work ethic that has allowed me to be successful in my undergraduate studies. Since my childhood I have always had a curiosity for how and why things work and function the way they do. This, along with my interest in math and science, led me to the University of Dayton, pursuing a degree in Mechanical Engineering.

Recently, I completed a class entitled Energy Efficient Buildings. In this class I learned a lot about the fundamentals of HVAC design, energy modeling, and many sustainable design practices for commercial and residential buildings. This class has raised my interest in building energy consumption and I hope to begin working in this field when I graduate this May.

Abstract: Energy is a growing concern as many of the natural resources we rely on deplete. The buildings we live and work in are responsible for about 1/3 of all the energy consumed. The research I am doing involves the use of a four-step process analyzing the utility data of houses to target those that could use energy efficiency upgrades. The four step method is made easy by the software Energy Explorer C. We are using this method to make energy saving recommendations to some area home owners. The paper attempts to summarize the method and report recommendations made.

Additionally, we are looking at houses from the Dayton area that use non-traditional methods of heating and cooling. One goal is to discover the limitations, if any, of this utility data method. Finally, it is of interest to develop a web- based method where homeowners can input their utility data and house characteristics to receive recommendations on improving their home’s energy efficiency.

Publications: None yet.
Biography: I was born and raised in Marietta, Ohio, at the crossroads of the Midwest and the Appalachian Mountains. Living here has given me an appreciation for the outdoors, folk music, and traditional values. My decision to study petroleum engineering was based on the influence of my father, who is in the oil industry, my uncle, who is an engineer, and my desire to stay close to home for college. It was one of the best decisions I ever made because it has given me the chance to visit different parts of the U. S. and contribute to the production of oil and gas at this critical point in history.

Abstract: For this project I will study hydraulic fracturing simulation as it pertains to Marcellus shale completions. First, I will learn to operate the MFrac software by Meyer & Associates in order to design a pumping schedule that will achieve an optimum fracture length and conductivity. I will also have to do a geologic review of the Marcellus shale and acquire logs of Marcellus completions in order to obtain the input variables for the MFrac program. Using the software I will determine the optimum fracture treatment for a particular Marcellus well. Then I will predict the well’s performance and compare this data to the well’s actual performance, if this data is available. This study will result in greater insight into the uniqueness of Marcellus shale completions and will provide an opportunity for me to improve my research skills.

Publications: None yet.
Biography: I am currently a junior at Marietta College in Marietta, Ohio. I am majoring in Petroleum Engineering with a minor in Mathematics. Science and math have always been the areas of academics that appealed most to me and, after high school, I wanted to pursue something in those areas. I have always liked problems with concrete, meaningful solutions, so engineering was a natural fit for me. Mere theorization does not suffice for engineering problems; they must be solved.

I feel that Marietta College is the perfect place to prepare for a career in engineering. I grew up in Ohio and wanted to stay in the area. After a few visits to Marietta, I knew it was the right place, and after meeting the wonderful faculty, I knew Petroleum Engineering was the right discipline. While Petroleum Engineering is not the most widely talked about discipline, it is exciting and always on the extreme cutting edge of technology.

Marietta College is conducive to more than just academics. I love the small school atmosphere and I am involved in many activities. I am a member of the Society of Petroleum Engineers, the Symphonic Wind Ensemble, and the Jazz Ensemble.

In addition to the instruction I am receiving at Marietta College, I also learned a great deal from working as an intern for a summer at an artificial lift company in Ohio. I benefited greatly from this first introduction to the oil and gas industry. The experience hugely increased my knowledge of artificial lift technology and introduced me to many other areas of the industry.

Abstract: It has been known for some time that large, underground shale formations in the United States hold vast amounts of natural gas. Only recently, however, has the technology to produce this gas become available and economical. Unlike traditional oil and gas reservoirs, shale formations possess very low permeability. Therefore, special techniques must be used in order to economically produce from these formations. Drillers and producers use many varied technologies, such as horizontal drilling or artificial lift equipment. Often many different production methods are combined together.

One of the most common approaches for increasing the production of a reservoir is to hydraulically fracture the formation. A fluid is pumped at high pressure into a well bore in order to break apart the formation rock. A high permeability proppant such as grains of sand is injected into the new fractures to hold them open. This method increases the permeability of the formation and allows for more gas to flow through the rock and into the well bore.

Advanced computer software is used to model oil and gas reservoirs and to design proper fracturing plans. Given the parameters of the formation, the software can assist the engineer in selecting fracture fluids, proppants, and pumping pressures.

This project will be an investigation of the methods being used to produce natural gas from shale formations, with a special emphasis on hydraulic fracturing and the utilization of natural fractures. The Marcellus Shale in western Pennsylvania contains a network of natural fractures that, when coupled with artificially created fractures, could greatly produce natural gas production. In addition to the investigation, this project will include actual fracture design for a formation, created with the aid of computer software.

Publications: None yet.

Congressional District(s): 18th
Congressional Representative(s): Zachary T. Space
Holly N. Slonecker

Status: Junior, Mechanical Engineering

Research Topic: Progenerative Prosthetic Bone Development

Advisor(s): Professor Robert J. Setlock, Jr.

Biography: I am originally from Wapakoneta, Ohio, and I am currently a junior at Miami University. As a Mechanical Engineering major and a Business Management minor, I am primarily interested in biomechanical engineering and biomedical project management. At Miami, I am a member of Tau Beta Pi, Vice President of the School of Engineering and Applied Sciences Dean's Student Advisory Council, a member of the student-run Vision Dance Company, and a current Ohio Bioinformatics Consortium scholarship recipient. As a member of the Miami University Honors Program, I am the President of the Honors & Scholars Advisory Board as well as a Bishop Fellow. The Advisory Board serves as a student advocacy board and a link between Miami students and the Honors & Scholars staff, while as a Bishop Fellow, I serve as a peer advisor to other Honors & Scholars students.

In the summer of 2008, I lived in downtown Chicago and interned for a small engineering and design consulting firm called Square 1 Product Development. I also volunteered as an assistant coach at a nonprofit organization called Girls in the Game.

After I receive my Bachelor’s Degree, I plan to attend graduate school to complete my Master’s Degree in Biomedical Engineering. Eventually I would like to work as a project manager in the field of medical device development. Specifically, I would like to serve as a link between companies who are developing medical technology and hospitals who want to best utilize these resources.

Abstract: This project investigates the factors influencing bone remodeling within the human skeleton with a focus on developing methods for constructing prosthetic bone material that progenerates into living bone upon implantation in the body.

Bone remodeling is the process of simultaneous removal of old bone and replacement with new bone powered by the coupled actions of osteoclasts and osteoblasts, cells that resorb bone and produce bone, respectively. While bone remodeling occurs more intensely during skeletal development, it continues throughout a human’s lifetime, repairing microscopic damage resulting from stress and fatigue on the body. There are many different models that describe how remodeling may occur as well as what initiates the remodeling response to damaged bone.

Bone engineering is an important and relatively new field of biomedical engineering. Prosthetic bone implantation could improve the lives of those affected by skeletal injuries, bone cancers, and degenerative diseases such as osteoporosis. This research is focused on how the concepts of bone remodeling might best be replicated to generate prosthetic bone that will be accepted by the skeletal system and progenerate into living bone. Because remodeling is such a complex process, many factors must be considered, including the type, composition, and purpose of the bone tissue being remodeled, the general growth cycle of the bone, and the typical stressors subjected upon the bone.

Publications: None yet.

Congressional District(s): 4th

Congressional Representative(s): Jim Jordan
Biography: I am currently a Junior Mechanical Engineering major at Ohio Northern University. I have always had a love for math and the sciences. In seventh grade I took high school honors algebra, followed by honors geometry in eighth grade. I excelled in my mathematics courses all through high school, and thoroughly enjoyed them. My favorite classes in high school were calculus and physics. I graduated from Strongsville High School in 2006, excited to pursue a degree in mechanical engineering. While studying at Ohio Northern I have gained a great interested in the thermal sciences, and their applications. This has led to my interest in aeronautics and astronautics.

This past summer I had the opportunity to intern with Sierra Lobo Inc., a company that is part of the TFOME contract at NASA Glenn Research Center. My experience helped to fuel my interest in the aeronautics and astronautics industry. Upon graduation I plan on pursuing a Ph.D., most likely focusing on thermal sciences.

Abstract: A new and exciting propulsion system is being used for deep-space missions; ion propulsion. An IPS (ion propulsion system) accelerates ions to create the thrust needed to propel a space craft. This new technology has been used recently on a number of deep-space exploration missions.

The capabilities of ion propulsion systems are just beginning to be realized. A comprehensive study of the thrust capacity, cost, and efficiency of ion propulsion systems has been created for this project. The purpose of this research is to explore the potentials of this new form of propulsion.

Publications: None yet.
Status: Senior, Mechanical Engineering

Research Topic: Construction of Wind Turbines at Ohio Northern University

Advisor(s): Jed E. Marquart, Ph.D., P. E.

Biography: I am currently a Senior Mechanical Engineering major at Ohio Northern University. My passion for engineering arises from the endless unaddressed problems of the world today. I strive to answer these questions through my endeavors as an engineer. My motive is not to earn a great deal of money or to receive recognition for my accomplishments, but to do something that can never be repaid.

At Ohio Northern University, while primarily focusing on my studies, I also pursue a variety of extracurricular activities. I am currently active in Tau Beta Pi (the national engineering honor society) as well as Phi Sigma Rho (a sorority for women in engineering). I also serve each year on a Habitat for Humanity trip. I keep myself physically active by participating in intramural tennis, basketball, and volleyball.

This past summer, I interned at American Electric Power in Columbus, Ohio. I provided engineering technical support to their fleet of coal-fired power plants. I also researched wind turbine manufacturers to assist with the selection of a wind turbine for AEP’s newest wind turbine farm. More recently, after participating in the Ohio Northern Engineer-in-Residence Program, I accepted a full-time position after graduation with Marathon Oil Company as a Project Engineer I in Findlay, Ohio.

Abstract: The objective of the Wind Turbine Team is to promote the use of wind power at Ohio Northern University and to evaluate the technical feasibility of such a venture. The final deliverable will be an economically viable plan for the future implementation of wind power at Ohio Northern University. If wind turbine construction is deemed the most suitable solution, recommendations for the type, number, location, and connection equipment for the turbines will be provided for future use during the implementation phase of this project.

The process of evaluating the use of wind power began when the anemometers located on the university radio tower first logged data on campus in mid-August 2008. Through the analysis of this data and through the investigation of the economics of wind power, the objective is to prove the feasibility of harnessing wind power at Ohio Northern University. However, a technical approach is required in order to fully determine the best possible locations for the turbines, the electrical tie-in to the grid, the expected output of a wind turbine, etc. Securing the approval from the university and obtaining the necessary funds will present the largest challenge for this venture. The ultimate goal is to establish a thorough proposal and presentation for the President of Ohio Northern University and his Board of Trustees in order to obtain approval and funds for the construction of the wind turbines.

Publications: None yet.
**Douglas J. Hoersten**

**Status:** Senior, Mechanical Engineering

**Research Topic:** 2009 ASME Design Competition: 'Mars Rocks' Vehicle

**Advisor(s):** Jed E. Marquart, Ph.D., P. E.

**Biography:** My name is Doug Hoersten and I am a Senior Mechanical Engineering major with a minor in Business at Ohio Northern University. I'm very active here at ONU in academic and nonacademic organizations. I am a current member of the American Society of Mechanical Engineers.

When I was approached about an aeronautical research project, I knew that it would be something involving model rockets. I have been interested in model rockets since I studied them in 4H when I was younger.

After graduation, I am undecided on whether I will go to graduate school or simply join the workforce. In my free time, I enjoy playing sports, traveling, and watching movies.

**Abstract:** The object of my senior design capstone is to design a remote-controlled vehicle to retrieve and place different sized rocks, to and from specified locations while surmounting various obstacles. The vehicle must be powered by batteries and must fit into a box with specified dimensions. It must maneuver the course without touching the edge boundaries and must be parked in the specified zone within the allotted time limit.

This project is intended to conform to the requirements of the 2009 ASME Design Competition. The competition, entitled "Mars Rocks", is intended to encourage the development of a vehicle capable of conquering the environment of Mars. The vehicle must be able to collect rock samples from the surface and place them in a location that will allow them to be studied or returned to Earth. The purpose of collecting rocks is to discover if life on Mars ever existed.

Our design must accomplish two basic tasks: surmount an obstacle 3.5 in. tall and collect and place rocks into given locations. The vehicle must use a remote control, and the power to both vehicle and controller must be supplied by readily available batteries. A box measuring 14.6 in. x 6.5 in. x 6.5 in. inside must contain all parts and the controller. The vehicle must come from the box ready to control. Only one team member at a time can control the vehicle. The vehicle must have an easily accessible master shut-off switch.

There are a few issues surrounding this project: the vehicle must be able to surmount an object 3.5 in. high, while still maintaining a size to fit in the designated space. This requires a sophisticated suspension and drive train. The motors must use a minimal amount of energy from the battery packs. Otherwise, more packs or higher capacity packs may be needed. The vehicle must be able to gather and place a variety of rocks of multiple sizes, shapes, and masses. This means that the mechanism for gathering rocks must be highly adaptable. All of these issues are constrained by the dimensions of the box. Parts may need to be scaled down, lighter versions may need to be created, or methods for unfolding or extending certain parts may need to be incorporated into the design.

*Continued on the Next Page...*
Douglas J. Hoersten (Continued)

Abstract: (Continued)
If the tasks can be accomplished by remote control, a more thorough search of the surface of Mars will be possible. The small size of the vehicle allows more space while transporting it to the surface of Mars and would reduce fuel consumption. Using a readily available power source reduces the cost and increases the reliability of the vehicle during its missions. Finally, the collection of Mars rocks for study and analysis would give scientists a better insight into the history of Mars.

I will present the work that myself and my capstone group members (Thomas Adam, Darren Nelson, and Jason Sweterlitsch) completed. The competition is in March, so I should have the results and our final vehicle to present at the OSGC presentation in April.

Publications: None yet.
Biography: I am currently a Mechanical Engineering major at Ohio Northern University. I am an officer in the Fellowship of Christian Athletes and in the student branch of AIAA. I’m a member of the cross country and track teams, as well as a member of the honors Program.

As a child, I was always interested in the sciences and how the world worked. I would always ask my dad how birds could fly, and why the sky is blue. Instead of him writing me off, he would try and explain lift for the birds, or the way the light reflects off the air to make it appear blue. I would not always understand, but my dad always encouraged me to ask questions. As I got older, I understood more and more, and my dad would give me books about physics and biology. When it came time to choose a college major, I knew that it would have to involve science, and it was between biology and engineering. I decided that engineering would be the better fit for me, and that is how I got to where I am today.

Upon graduation I hope to obtain a job related to the field of Mechanical Engineering. I enjoy the classes in the thermal sciences, and hope to obtain a summer internship working in the thermal sciences.

Abstract: During this past year, my research has focused on the design of SCRAMjets. In particular, I have been reading literature that has been written by various other engineers. I examined the primary considerations for use of a SCRAMjet, such as payload, range, and ideal velocity. When examining the actual SCRAMjet, attention was paid primarily to the cone shape and the nozzle size and how this affects the flow in the SCRAMjet. These are the preliminary steps needed in order to eventually model a scramjet using CFD.

Publications: None yet.
John Matthew Rader

**Status:** Junior, Adolescent to Young Adult Education (AYA), Mathematics

**Research Topic:** Shrinking Down the Solar System

**Advisor(s):** Sandra Schroeder

**Biography:** In 2006, I graduated from Cory Rawson High School. I am currently a junior at Ohio Northern University and will graduate in 2010 with a Bachelor’s Degree in Mathematics Education. I am a member of the Ohio Northern baseball team. After I graduate from college, I plan to obtain a teaching job from around my area. I would also like to become a football and baseball coach at the school I will be teaching. While teaching, I will finish my education by working on my Master’s Degree in Mathematics.

**Abstract:** For my lesson, I am going to incorporate the solar system into a geometry lesson. The night before I start the lesson, I will have students research the planets and the sun. They will be required to find either the circumference or radius of each planet along with how far apart the planets are from each other. During class the next day, we will discuss as a class what information was found. We will then scale down the sun in order to be the size of a basketball. After we find out the ratio for the sizes, the class as a whole will then scale down the planets.

When all of the calculations have been completed, the class will work together to make the proper shapes of the planets in the same scale as the sun. This will be done by either using a spherical object I bring to class, or using Play-Doh to mold a planet.

The next day, I will scale the size of the sun down to marble size. Together, the class will then figure out the distance between all of the planets using the new scale. After we finish computing all of these measurements, I will take the class outside. I will have one student hold the “sun” at one end of the football field. One student will then proceed to stand where each planet should be using our calculations.

When this activity is completed, the students will be given a worksheet. Problems will consist of figuring out how much it would cost to travel from one planet to another, how long it would take to travel from one planet to another, etc.

**Publications:** None yet.

**Congressional District(s):** 4th

**Congressional Representative(s):** Jim Jordan
Biography: I attended The Ohio State University for my undergraduate studies, majoring in Materials Science and Engineering, and continued my education at OSU as a Master's student in the Materials Science discipline. I have been an active member in The Honor Society of Phi Kappa Phi, Alpha Sigma Mu, and The National Society of Collegiate Scholars, as well as volunteering as a promoter for women in engineering, particularly the study of materials.

I was involved as an undergraduate student researcher under the direction of Robert Rapp, Professor Emeritus at The Ohio State University. My student research project involved the investigation of the formation of open bottom bubbles in the float glass process, and the parameters necessary to diminish the presence of open bottom bubbles. I have always had an interest in the biological/medical field, and that interest led me to my graduate research project involving the mechanical testing of bone, under the direction of Katharine Flores, Ph.D.

Abstract: Bone is an anisotropic, hierarchically structured material, and as a result its mechanical behavior is highly statistical in nature. It has been shown for other engineering materials that mechanical testing at the microscale under simple uniaxial loading conditions enables characterization of individual microstructural components in an effort to understand their role in the macroscopic mechanical behavior. The application of such microscale testing to bone will permit modeling of the aggregate material to predict effects of age, disease, or injury on the mechanical properties.

In the present work, a femtosecond (FS) laser micromachining technique is employed to produce microscale mechanical test specimens of bovine cortical bone. The FS laser uses ultrashort laser pulses to ablate the material by locally heating it to its vaporization temperature, creating a plasma that is dissipated into a flowing gas. The FS laser is advantageous for micromachining of biological materials because it may be used in ambient, non-vacuum environments, making it a flexible tool for machining the bone surface while preserving its microstructure. The short pulse duration minimizes thermal diffusion and heating of the surrounding material. Prior research suggests that FS laser machining causes very little residual damage to the surrounding bone tissue. In the present study, “micropillar” specimens with cross-sectional dimensions on the order of 10µm have been produced for compression testing. Future work includes investigating additional manufacturing techniques to construct pillars with diameters of 1µm or less.

The pillars will be used for micromechanical testing of time independent behavior using a modified nanoindenter with a flat punch tip. By achieving successful fabrication of micron and sub-micron scale pillars, it is possible to test the constitutive mechanical properties of mineralized tissue that comprises bone. The microscale testing of both cortical and trabecular bone allows for a comparison of the mechanical properties to determine if there exists any similarity which may lead to a further understanding of the effects of osteoporosis or other diseases on bone tissue and the ability of such tissue to adapt to mechanical loading.

Publications: None yet.
Biography: Originally, I am from Bay Shore, New York. I attended The State University of New York at Stony Brook for my undergraduate education. As an undergraduate, I explored several areas of mathematics, electrical and computer engineering and took a special interest in real analysis and signal processing. I was also a member of the local IEEE chapter and served as treasurer for a year. In the summers of 2001 through 2003, I worked as an engineering intern at Symbol Technologies in Holtsville, New York. In 2003, I graduated with a B.E. in Computer Engineering and a B.S. in Mathematics. The same year, I moved to my current residence in Columbus, Ohio, to pursue my Master's Degree in Electrical Engineering at The Ohio State University.

At The Ohio State University, I am part of the Information Processing Systems (IPS) Lab. As a Master's student, my research was focused on reconstructing 3D images using interferometric synthetic aperture radar. In 2006, I published a thesis on my research and received an M.S. in Electrical Engineering. That summer, I worked at SET Corporation located in Dayton, Ohio. My work was on 3D radar image reconstruction using a recently collected data set from the Air Force Research Lab (AFRL). I am currently a doctoral candidate at The Ohio State University, and my current research interest is in radar signal processing, detection and estimation, and sparse reconstruction algorithms.

Abstract: Typically parametric estimation problems involve two steps: determining the model order and estimating the parameters in the model. After the model order is selected, the parameters are determined by solving an optimization problem over a continuous range of values that the parameter may assume. Recent research has shown that it is possible to accurately recover sparse (mostly zero entry) input vectors to systems that are highly underdetermined; that is, the system matrix has many more columns than rows; the output vector of the system is the discrete measurements of the system. Accurate recovery is a function of the intercolumn correlations of the system matrix.

In this work, we pose the model order selection and parameter estimation problem of an additive model as a sparse vector recovery problem. The continuous parameter space is sampled, and the additive component function of the model is evaluated at each of the parameter samples. Each of these component samples forms a column of the system matrix. Rows of this vector correspond to samples of a measurement variable, such as time or space, which the designer has control over. Selection of columns in the system matrix corresponds to selection of how many components and which parameters are in the additive model. A sparse reconstruction algorithm is used to find a sparse input coefficient vector to the system. This vector determines which sparse set of columns contributes to the output. The number of non-zero entries is the model order, and the columns selected by non-zero entries encode the parameter estimate of each component in the model.

In Synthetic Aperture Radar (SAR), electromagnetic returns from the radar can be represented as a sparse additive model; so, the proposed estimation method is applicable to SAR parameter estimation. Selected columns of this system matrix encode locations of objects in a scene that scatter electromagnetic energy, and the input coefficient vector to the system encodes the amplitude of each scattering object. Object amplitudes and locations are represented as a radar image. In the context of SAR, parameter sampling determines the resolution of the radar image.
Abstract: (Continued)
Ideally, in this sampled parameter estimation approach, one would sample the parameter as finely as possible to decrease quantization error, but arbitrarily small sample size will result in high intercolumn correlation of the system matrix, which will lead to spreading of non-zero coefficients to adjacent entries in the reconstructed vector. We study parameter estimation performance for different parameter sampling schemes and as parameter sampling spacing decreases. Performance and the relation between this sampled parameter estimation approach and traditional continuous parameter estimation will be examined. SAR image resolution will be studied as a particular example of the effect of parameter sampling methods on estimation performance. This research could be used by AFRL in feature extraction or automatic target recognition applications.

Publications:
Krista M. Kecskemety

**Status:** Doctoral - 1, Aerospace Engineering

**Research Topic:** Computational Wind Turbine Aeroelasticity

**Advisor(s):** Dr. Jack McNamara

**Biography:** I attended The Ohio State University and graduated Summa Cum Laude in June, 2006, with a Bachelor of Science Degree in Aeronautical and Astronautical Engineering. While an undergraduate student, I had the opportunity to intern with Eaton Corporation holding a variety of assignments from developing a new mechanical part to working with the environmental, health, and safety group.

Following graduation, I entered a non-thesis masters program at The Ohio State University, with coursework focusing on fluid flows. I received my Master of Science Degree in June, 2007. After attaining my Master’s Degree, I began my Ph.D. program in the field of aeroelasticity. In addition to aeroelasticity research, I had the opportunity to participate in engineering education research at The Ohio State University with Dr. Kathy Harper. The research focused on improving instruction for problem solving methods and skills.

During my college education, I have had the opportunity to teach, both as an undergraduate and graduate teaching assistant for first year engineering students. Through this experience, as well as my research experience, I have worked toward my goal to enter academia upon completion of my Doctoral Degree.

**Abstract:** concerns on the global climate, continual growth in energy demands and finite fossil fuel supplies. Wind turbines, which capture wind energy and convert it to electrical power, are a form of renewable energy that has made significant advancements in the last few decades. Over the last 25 years, wind turbine technology has improved power output by a factor of 100, to 5 MW electrical output machines\(^1\). However, in order to fully utilize this technology a significant amount of design optimization and research is required\(^2\).

Design optimization of wind turbines is a challenging endeavor; however, since an accurate analysis must include aeroelastic effects (aeroelasticity involves the mutual interaction between the inertial, elastic, and aerodynamic forces in a system\(^3\)). Aeroelastic effects are important to wind turbine design optimization and analysis since the turbine blades are composed of thin, high aspect ratio structures rotating in an unsteady flow\(^2\). While current aeroelastic codes do not account for large deflections, the increasing length and flexibility of wind turbine blades has made large deflections a reality and should be incorporated into aeroelastic wind turbine design codes\(^2\).

The development of offshore wind turbines is an exciting prospect for this form of renewable energy due to widespread availability of open area and more lenient noise restrictions\(^1\). Thus, while a majority of turbines are still built on land, in the next decade offshore turbines are expected to increase\(^1\). However, a challenge with offshore wind turbine is increased complexity of aeroelastic phenomena by increasing the role of nonlinear aeroelastic effects\(^1\). Adding structural nonlinearities to aeroelastic design codes and the ability to model offshore wind turbines, will provide more accurate design tools for engineers.

Continued on the Next Page...
References:

Publications: None yet.
Ehsan Sadeghipour

Status: Senior, Mechanical Engineering
Research Topic: Robotic Joints

Advisor(s): Marcelo Dapino, Ph.D.

Biography: I am currently a Senior Mechanical Engineering student at The Ohio State University. After visiting a hydroelectric power plant at age 10, I could not stop thinking about how fast, big, and exciting everything was. I had seen large buildings and fast-moving components before, but the concept of an enormous building that produced electricity from water was still amazing. Our group of visitors consisted of me, my father and his graduate students, who translated their interest into an understanding of the processes involved; I, however, was forced to remain curious as I was only in fourth grade. On that day I began to realize that only through obtaining an engineering education would I be able to understand the structures and machines I found exciting to watch. I plan to learn the principles of Mechanical Engineering in my undergraduate career, and then continue on to graduate school to receive a PhD in this field. As an undergraduate student I have the great opportunity to reap the fruits of others’ curiosity through my courses, whereas as a graduate student I will have the unique opportunity to learn by researching what I am curious about. After obtaining my Ph.D. I plan to conduct mechanical engineering research as a university faculty member.

Abstract: The development of machines that locomote as bipeds is a solution to mechanical locomotion on other planets. Two problems in developing autonomous versions of these machines are energy consumption and the risks associated with the possible impact of robotic components with the astronauts around them. Research has shown that using variable compliance, or elasticity, in robotic joints can decrease both of these factors. This project has focused on developing variable compliance robotic transmissions to increase biped walking efficiency and to decrease the impact forces associated with a possible collision. The results of this study are important in developing autonomous robots that can safely interact with astronauts for an extended period of time.

Publications:

Congressional District(s): 15th - OH; 14th – PA
Congressional Representative(s): OH - Mary Jo Kilroy; PA - Michael F. Doyle
Michele M. Martin

Status: Sophomore, Dietetic Technology

Research Topic: “Space Anemia” and Bone Loss

Advisor(s): Tekla Madaras, M.Ed., R.D., L.D.

Biography: As a sophomore in the Dietetic Technology Program at Owens Community College, I will be graduating in May, 2009. I graduated from Sylvania Northview High School in 2002. I previously attended Owens Community College and graduated with an Associate Degree in Liberal Arts in 2004. I transferred to The University of Toledo to pursue my degree in Global Studies and French. I decided to go into the Dietetic Technology Program because I was interested in nutrition and health. Upon graduating from Owens, I plan on taking the registration exam for DTRs and continuing my education to become a Registered Dietitian. Eventually, I would like to pursue a degree in public health as well as volunteer with the Peace Corps or another program abroad.

Abstract: Nutritional losses are of great concern at high elevations, including space flight. Risk of iron deficiency, bone loss, and muscle wasting are issues which need to be tended to when evaluating individuals for flights. When astronauts step back down to sea level after being in space, the immune system is weakened and the following factors must be verified to assure a healthy life: heart function, red blood cell production, as well as blood flow.

Publications: None yet.
Incorporating More Antioxidants in One's Diet During Space Flight

Research Topic:  Sophomore, Dietetic Technology

Advisor(s):  Tekla Madaras, M.Ed., R.D., L.D.

Abstract:  Antioxidants are nutrients and enzymes that play a role in helping prevent the development of chronic diseases such as cancer. They counteract the stress and damage that is done by free radicals and the normal process of oxidation in tissue. Free radicals are molecules with one or more unpaired electrons, which allow them to become very unstable. They search one’s tissues for a place to exchange electrons, which can cause mutations in one’s DNA. Antioxidants play an important role in space travel diet. Space travelers are at an increased risk of developing certain types of cancer due to constantly being exposed to free radicals that naturally occur in forms of radiation. Their diets should be full of dietary sources of antioxidants such as vitamins A, C, E and selenium, as well as non-nutrient sources of antioxidants such as phytochemicals. Since antioxidants are found most abundantly in fruits, vegetables and nuts, it would be most beneficial to carry as much of these items possible upon space flights. Most foods brought on flights are dehydrated and according to the Journal of the American College of Nutrition, in terms of dried fruit, dried figs and plums have the best nutrient scores of antioxidants.

Publications:  None yet.
The University of Toledo

Jonathan J. Guernsey

Status: Doctoral - 3, Electrical Engineering
Research Topic: A Dynamic Virtual Multi-Protocol Network Architecture

Advisor(s): Dr. Lawrence Miller

Biography: I was born in the Toledo Hospital and grew up in various cities in northwest Ohio. I graduated from Rossford High School, a small city just south of Toledo. As I grew up, my parents heavily encouraged me to learn everything and anything I wanted. I eventually became a jack-of-all-trades. I learned skills in a multitude of areas, becoming a multi-faceted musician, an artist, a published poet, a writer, a mechanic, a craftsman, a gamer, and even a seamstress to name but a few. I have yet to find a topic that I am not willing to learn.

After high school, I enrolled at The University of Toledo, where I studied both Electrical Engineering as well as Computer Science and Engineering. During my undergraduate program, I took part in several student organizations. I was a member of the marching band as well as the honors college and even had my share of failures. I worked outside of the campus at various jobs including technical support, sales, computer consulting and even a professional engineering internship at Davis-Besse Nuclear Power Plant. I graduated in 2001 receiving a Bachelor of Science in Electrical Engineering, a Bachelor of Science in Computer Science and Engineering, and College and Departmental Honors for completing the Honors program requirements.

My intention has always been to go into research and teach at a college level. Upon graduating, I enrolled in the Master’s Program in the Electrical Engineering and Computer Science Department, focusing on software and intelligent systems. It was at this point, that I met my advisor and friend, Dr. Lawrence Miller. He encouraged me to start my Ph.D. requirements as quickly as I could, so I directly enrolled into the Ph.D. program, selecting a focus of advanced computational systems, and worked to complete both graduate programs in tandem. During my graduate career, I have taught many engineering labs, taught several class sessions for professors, and have been invited into several prestigious organizations including Phi Kappa Phi and Phi Kappa Delta. I also have received several awards, my favorites being an Outstanding Teaching Assistant award and my OSGC Fellowship. So far during my Ph.D. program, I have had the opportunity to teach Computer Organization and Assembly Language Programming and Introduction to Computing in C++. These experiences have been wonderful and have reinforced my intent of entering the academic field. Currently, I have completed all of my course requirements for both graduate programs, passed my Ph.D. comprehensive qualifier, received Ph.D. candidacy status and have delved into my research topic. Outside of school, I teach Tae Kwon Do, substitute teach for a few school systems, teach at ITT Tech, dabble in my hobbies and am married with 3 children. Upon graduation, I intend to enter the academic field at the college level to teach young engineers, as I enjoy passing on the knowledge I have learned.

Abstract: The Internet has become the largest and most highly used global communications network in the world. Despite its functionality and high usage, it has shortcomings in a multitude of areas, including quality of service (QoS), security, robustness, availability, reliability, management, extensibility, and adaptability. It has been found that the Internet is ossifying to the point where it is extremely difficult to deploy new technologies and services, even ones from which the Internet would significantly benefit. This is due to the fact that the foundation of the Internet, the TCP/IP architecture, is almost “set in stone”. Even integration of security into the architecture has been a daunting challenge considering that the TCP/IP protocol stack was developed for DARPA as an open, highly available, highly robust, “always on” network.

Continued on the Next Page
Abstract: (Continued)
Since the Internet started becoming a global network, major research has gone into alternate network technologies, services and techniques with the intent of providing the requisite functionality in a deterministic fashion. For a multitude of reasons, most of this research has been abandoned. At the present time, the National Science Foundation (NSF) is actively pursuing an academically driven project called FIND (Future Internet Design) with the intent of seeking out new ideas to help found a new Internet that is intended to replace the existing Internet. This research is building such a system.

The current requirements of network applications are vast and change drastically from one network application to the next. This cannot be provided by a static monolithic protocol architecture; a dynamic multi-dimensional protocol architecture is needed. It is envisioned that the future networks will be comprised principally of very high speed wireless, multi-gigabit speed Ethernet and single as well as multi-wavelength fiber. Leveraging the power of these extremely high speed mediums and the power of virtual circuit based technologies; a dynamic protocol stack framework, VIMNet, that uses protocol modules is being designed.

Publications:
### Biography

I live in Maumee, Ohio, and attended Maumee Valley Country Day School from preschool through high school. In the Fall of 1999, I began undergraduate studies in computer science and engineering at The University of Toledo (UT). During the course of my undergraduate college career, I worked as an engineering co-op for Owens-Brockway in Perrysburg, Ohio, as well as Hewlett Packard’s VLSI Design lab in Richardson, Texas. I was also honored with membership in Eta Kappa Nu, Tau Beta Pi, Pi Mu Epsilon, Phi Kappa Phi, and Golden Key honors societies.

After graduating with a Bachelor’s Degree in August of 2003, I began a Master’s Degree program in electrical engineering. My research study on the development of a neural network based state of charge predictor for lithium-ion battery cells was supported by an OSGC Master’s fellowship as well as a UT College of Engineering Dean’s fellowship. Currently, I am pursuing a Ph.D. in electrical engineering at UT with a focus on satellite communications design and analysis. In addition to satellite communications, my research interests include machine learning, embedded systems and acoustic emission processing.

### Abstract

Currently, many satellite systems possess the ability to perform transponder level switching at intermediate frequency (IF). That is, the satellite can switch channels from any uplink slot to any desired downlink slot; however, the complexity of communication satellites is ever-increasing as a result of growing demand for greater data throughput and increased flexibility. Of particular interest is the ability to perform switching at the data packet level. Toward this end, satellite systems are now being designed to incorporate on-board processing (OBP), wherein the originally transmitted data sequence is recovered on-board the satellite payload and reformatted (and switched as needed) for downlink transmission. Typical examples of broadband services provided by OBP satellites are direct-to-home television, high-speed internet, video conferencing, telephony, distance education, telemedicine and access to large databases.

Signal impairment represents a significant problem for satellite communications systems. Compromised signal integrity is the result of many factors relating to channel conditions and system hardware limitations. Typically, for a given waveform and satellite payload architecture, a select number of impairment factors can be identified as being critical. In this research study, channel impairment factors (such as additive white Gaussian noise, partial-band noise jamming, band-multitone jamming, and fading) and system inherent degradation factors (such as quantization noise, nonlinear travelling wave tube amplifier, and local oscillator injected noises) are considered.

### Congressional District(s):

9th

### Congressional Representative(s):

Marcy Kaptur
Abstract: (Continued)
For most of these impairment factors, channel coding and frequency hopping have proven very successful at improving overall bit error rate (BER) performance; however, when considering carrier phase noise and frequency offset, which are primarily attributed to channel fading conditions, additional compensation techniques are required. Much of the current literature proposes the use of iterative decoding schemes to improve phase integrity or embedded pilot symbols to estimate channel conditions and correct the signal accordingly for specific system architectures and waveforms. This research study proposes the use of machine learning algorithms in the development of a generalized channel estimation and compensation scheme. Both IF and OBP satellite payloads will be modeled and subjected to various impairment factors to assess the efficacy of the proposed estimation and compensation scheme, and determine their overall BER performances.

Publications:
Emily E. Roth

**Status:** Junior, Chemical Engineering

**Research Topic:** Surface Modification of Polyamide Membranes

**Advisor(s):** Dr. Isabel Escobar

**Biography:** I am currently a senior at The University of Toledo and will graduate in December, 2009, with a Bachelor’s Degree in Chemical Engineering. As part of my course requirements, I have completed three co-ops and plan to complete a fourth this summer. The first two co-ops were in a research and development lab at a coatings facility for Pittsburgh Plate and Glass (PPG Industries). My third co-op was in the Power Generation Proposals Department at ABB Industries, which is where I will complete my fourth rotation. Although I’m not positive of what I’d like to do when I graduate, these co-ops and my experience with my research here at the university are helping me to determine a career path that is both challenging and rewarding.

**Abstract:** A membrane is a layer that serves as a selective barrier made from either polymer or inorganic film that is used to separate materials based on their physical and chemical properties when a driving force is applied across the membrane. Membranes are becoming very popular in the application of water treatment because they can be designed and modified to meet stringent standards in the industry while using significantly less space than some of the other separation techniques out there.

For my project, I am working to modify the surface of a polyamide membrane so that it will reject specific unwanted monovalent cations. The membrane I am working with is a nanofiltration composite membrane and will be used in wastewater treatment to further purify the water by removing the targeted cations.

**Publications:** None yet.
Miranda L. Steinberger

**Status:** Senior, Mechanical Engineering

**Research Topic:** Investigation of the Effects of Acoustic Cavitation on a Surface Close to a Sonotrode

**Advisor(s):** Dr. Efstratios Nikolaidis and Dr. Sorin Cioc

**Biography:** I was born and raised in Fremont, Ohio where I attended Fremont Ross High School. After graduating high school my engineering adventure began at The University of Toledo. It was a four and a half year ride full of exciting learning experiences in the realms of math and science. However, this journey came to an end when I graduated from The University of Toledo on December 19th, 2008, with my Bachelor of Science Degree in Mechanical Engineering. In early January of 2009, I began my career with the Marathon Oil Corporation at our Garyville, Louisiana refinery. I am employed as a refining engineer. In this position, I am responsible for various mechanical engineering requests within our process units and serve as a project manager for capital improvement efforts.

**Abstract:** The effects of acoustic cavitation were analyzed to determine the possibility of using acoustic cavitation to clean medical implants without causing damage to both the implants and the living tissue of a patient. The effect of the distance from an ultrasonic processor sonotrode to a surface on the intensity of the pressure on the surface was determined. This effect was examined and correlated to the period of the wavelength of the acoustic waves generated by an ultrasonic processor. The location where the cleaning effect from cavitation was the greatest was established. A profilometer created images and measurements of cavitation bubbles, which were used to determine the approximate pressure exerted on a surface due to the rapid, frequent collapses of acoustic cavitation bubbles. The established pressure was used to determine the approximate force generated by acoustic cavitation and its relation to the biofilm removal mechanism. The force determined was used to assess the effectiveness of cavitation for cleaning titanium surgical implants.

**Publications:** None yet.
### Biography
I am currently of junior status at Wilberforce University, aspiring to be a Computer Engineer. Born in Warrensville, Ohio, I’ve always been interested in computers. I still remember the first computer I was exposed to in the fourth grade. My mother worked late, and I was always the last to leave after school daycare subsequently giving me ample time to spend on this computer. My teacher almost had me teach my peers and faculty.

I guess this piqued my interests, and I’ve been playing with computers ever since. My confidence and passion for the field was just recently acquired though. When I started my major at Wilberforce University I was doing well until I hit programming. Programming is a major part of Computer Engineering, and I wasn’t sure if I could ever become an efficient programmer. This past summer I was interning at the Glenn Research Center working for SAIC (Science Application International Corporation). I received some help from another Computer Engineer and wrote a 1000 lined code that verifies if a piece of code is written well. Now programming in more than my interest it’s my passion, and I see myself writing code in the future.

### Abstract
CONNECT (Communication Navigation and Networking Reconfigurable Testbed) is a project I worked on this past summer that will test SDRs (Software Defined Ratios) in Microgravity. An SDR system is a radio communication system consisting of a computer equipped with a sound card, or other analog-to-digital converter, preceded by some form of Radio Frequency front end. SDRs covert analog signals to digital data for transmission and manipulation. My Engineer explained the difference between SDRs and frequency ratios. SDRs are programmable and can be manipulated to do multiple things while frequency ratios can only do one thing.

One SDR can replace ten frequency ratios and it was a mystery why they weren’t more widely used. I discovered SDRs are a relatively new technology; the name was just coined in 1991. One of its first applications was for the military, later used in satellites, and now NASA is doing extensive test of SDRs for space applications through CONNECT and the SAT (SDR Architecture Team).

### Publications
None yet.

### Congressional District(s):
14th

### Congressional Representative(s):
Steven LaTourette
Royel S. Bridges

Status: Junior, Electrical Engineering

Research Topic: Control of Plant Reactivity Using Reactor Recirc Water Flow (at The Perry Nuclear Power Plant)

Advisor(s): Dr. Edward Asikele

Biography: My name is Royel Stephon Bridges. I was born on November 9, 1987, in Cleveland, Ohio. Currently in Twinsburg, Ohio, a suburb outside of Cleveland, my loving family and I share a home. Most would consider my family to be large compared to others. My immediate family consists of 8 siblings, 5 sisters and 3 brothers. Growing up as a middle child, the experience of life as the oldest and the youngest of my siblings was fortunately obtained. Thus, I am an individual who has the ability to teach and at the same time have mastered the ability to learn.

Aside from my siblings, my family has also placed an importance on education. Though I am sure my younger siblings will each embark on a post education experience in college, I am the first male of all my siblings to enroll in college. I am currently a junior at Wilberforce University majoring in Electrical Engineering who has hopes of one day attending graduate school and receiving Doctorates in both my current field and Business Management. I hope to gain as much experience as possible in my field of practice and to put myself in the greatest position for accomplishment in my field of study. To accomplish such a goal, I will continue enrolling in internships and doing research. I currently have a 3.6 grade point average and will work to maintain or improve such.

As an Electrical Engineering major at Wilberforce University, the course curriculum is broad and can be demanding. Aside from the general study courses that are required, an electrical engineering major will undoubtedly graduate with a strong background in both math and sciences. As a junior beginning my main required engineering courses, my course load consists mainly of electrical engineering courses. As a junior at Wilberforce University majoring in Electrical Engineering, my goals consists of one day attending grad school and receiving a doctorates in both my current field and business management. I hope to gain as much experience as possible in my field of practice and to put myself in the greatest position for accomplishment in my field of study. Aside from scholastic goals, I plan to have a family, children, a wife, maintain a strong relationship with God, a beautiful home, and to make my mother proud. To accomplish these life focus objectives, hard work and dedication will become my life long partners in achieving these goals. I will continue to receive a high GPA to put me in an excellent graduate school and network to build strong business relationships. This will put me with a great career, the ability to support my family, time for religious study and practice, and put that smile on my mother's face.

Abstract: On February 7, 2009, I was given the opportunity to visit the Perry Nuclear Power Plant. Here I was given the once in a life time opportunity to use and operate a simulated control room that the plant uses for the training of their employees. In this control room I set in a senior operator position. Here I was instructed on how to operate certain controls at the main control unit. This unit is what the plant uses to control reactivity in the reactor core. There are three methods used at this specific plant to control reactivity. Those methods are as listed: (1) control rod level in to the core, (2) Stand-by liquid control, and (3) Reactor water recirc. Though I worked with all three methods, my main focus was that of the reactor recirc water. I conducted an experiment that tested the relationship between the increase of circulation water and the effect it had on the reactor power. With this method, water was injected directly in the core at interval increases of 5% water flow. My data results concluded that the increase of water flow into the core caused more neutron reactions thus creating more reactor power.

Publications: None yet.
**Kenya P. Carrington**

**Status:** Senior, Electrical Engineering  
**Research Topic:** Active Bandpass Filters  
**Advisor(s):** Dr. Edward Asikele

**Biography:** Currently I am a Senior Electrical Engineering major at Wilberforce University located in Wilberforce, Ohio. My passion for engineering began in high school. My high school, Baltimore Polytechnic Institute, paved the way for a career path in engineering and instilled in me the knowledge and skills needed to progress in the engineering field. The thing that fascinated me so much about the engineering field was the opportunity it provided for students to think analytically and apply that knowledge in an experimental or hands-on manner.

Originally my career goal included one day becoming an aerospace engineer and/or licensed pilot. However, after attending Wilberforce University, I learned to grow fond of electronics and how circuits were designed or constructed. Most of my time is spent peer-mentoring, tutoring, and participating in different organizations. I am a member of Alpha Kappa Mu Honor Society, Co-Captain of Trinity Drum-line Dance Team, and President of National Society of Black Engineers Wilberforce Chapter. At Wilberforce I have been given many opportunities to progress in my career just by attending different academic, technical, and professional workshops. One of the benefits this gives me is preparation for graduate school which I plan to attend after attaining my Bachelor's Degree in Electrical Engineering.

**Abstract:** According to President Barack Obama, America's dependence on oil is one of the greatest challenges America has ever faced; because it is a threat to the national security, the planet and the economy. He promised that renewable energy will help create five million new jobs by strategically investing $150 billion over the next ten years. President Barack Obama's pushed for more investment in solar and wind energy, saying that the country that can make renewable energy sources price competitive with traditional fossil fuels (oil and coal) will become the economic superpower of the future. The country that figures out how to make cheaper energy that is also clean, that country is also going to win the economic competition of the future.

A major type of renewable energy is Solar Energy. It is the energy produced by the sun's rays that reach the earth. Solar energy can be converted into other forms of energy such as heat and electricity. Solar Energy can be converted to thermal (or heat) energy and used to heat water for use in homes, building, or swimming pools. It can also be used to heat spaces inside greenhouses and homes. Also Solar Energy can be converted to electricity in two ways – photovoltaic or solar cells to change sunlight directly into electricity and solar power plant which indirectly generate electricity when heat from solar thermal collectors is used to heat fluid which produces steam that is used to power generator.

This project focus on the study of Solar Energy, the commitment made by United States of America government in the development of this renewable energy; and the expected result of government effort to figure out how to make cheaper energy that is also clean, and the prospect of winning the economic competition of the future.

**Publications:** None yet.
Dwight P. Cass, Jr.

**Status:** Senior, Electrical Engineering  
**Research Topic:** Expert System Simulation on Earthquakes in Southern California

**Advisor(s):** Dr. Edward Asikele

**Biography:** I am a graduating senior has truly made the best of my experience at Wilberforce University. In addition to being an Electrical Engineering major, I have also been an active member and has served as an officer to several organizations and clubs here at Wilberforce University; First VP of the Student Government Association, VP of the National Society of Black Engineers, Peer Mentor, tutor, United Negro College Fund to name a few. Coming from Camden, New Jersey, I have taken full advantage of all of the great opportunities at Wilberforce University. With the assistance of a tremendous cooperative education program, he had interned with NASA as well as the Dayton VA Hospital as an engineering intern. I enjoy building circuits, drawing schematics and research.

**Abstract:** The United States is home of some of the most deadliest and destructive earthquakes, more specifically within the Southern California area. California’s 35 million people live among some of the most active earthquake faults in the United States. Public safety demands credible assessments of the earthquake hazard to maintain appropriate building codes for safe construction and earthquake insurance for loss protection.

After looking at the high structural damage possibilities, farming and crop damage, and facilities adequate for safety, I started to research Stochastic/Expert Systems which are computer programs that use available information, heuristics and inferences to suggest solutions to problems in a particular discipline, in this case earthquakes. It can also be references to as a computer program which emulates the decision-making ability of a human expert. An Expert System contains knowledge gathered from an expert and various sources in a specific domain or area of research.

This expert systems report will be able to estimate the severity and magnitude of earthquakes, damage to buildings and structures. As well as the items listed above we must also consider how they affect the people in the surrounding communities. Our goal for our expert system as stated earlier will be to estimate the magnitude and severity of earthquakes and estimated damage to buildings.

**Publications:** None yet.

**Congressional District(s):** 7th - OH; 1st – NJ  
**Congressional Representative(s):** OH - Steve Austria; NJ - Robert E. Andrews
High Pass Filter as an Application in Everyday Objects

Research Topic: High Pass Filter as an Application in Everyday Objects

Advisor(s): Dr. Edward Asikele

Biography: I am currently a Senior Computer Engineering major at Wilberforce University. Originally I am from Philadelphia, and I decided to embark on a journey of higher education and my last stop was Wilberforce. For the first four years of my life, I was an only child in a two parent home. My dad always held my attention and his love for automobiles caught my eye as well. My father worked as a mechanic at Sears when they had an auto body garage. I adapted to the science behind cars quick as I would assist my father in various automotive projects that he had. As I continued to grow, I took in a love of science and math and excelled accordingly.

As a college student at Wilberforce University, I am one step closer to achieving my ultimate goal in engineering. While in school, I study various courses which allows me to look at how everything works, including the elements that could even be found in motor vehicles. I also have a good knowledge in Nuclear Engineering which opened my eyes even more into the engineering world. I am a member of the National Society of Black Engineers (NSBE) at my school and this organization really opens a lot of doors for all engineering majors. It allows us to come in contact with some elite engineering companies in the world and gives us the opportunity to sit and talk with them and embrace all that they have to offer. After obtaining a Bachelor’s Degree in Computer Engineering, I look forward to becoming a design engineer where I will be one of the many people who has input on the interior and exterior design of numerous automobiles.

Abstract: Within electronics, a filter is basically a device that separates unwanted signals from signals that are wanted, such as frequencies. An electronic filter is an electronic circuit that processes signals specifically intended to enhance wanted signal components. Such electronic filters can be passive or active, analog or digital, in discrete – time or continuous – time, linear or non – linear, or infinite or finite impulse responders. One of the oldest forms of electronic filters are passive analog linear filters which were constructed only using resistors and capacitors or inductors. There are several different pass band filters which transmit frequencies, such as with speakers, television sets, or car stereos. These filters are low – pass filters, high – pass filters, band – pass filters, band – stop filters and all – pass filters. High – pass filters among them all are more common because you get a better quality of sound and it can be found anywhere.

A high – pass filter passes high frequencies well, but attenuate frequencies lower than the cutoff frequency. The cutoff just refers to a boundary point where energy is reflected instead of transmitted. The simplest electronic high – pass filter consists of a capacitor, a device that stores energy in an electric field between two plates, in series with a resistor, a component that opposes and electric current by producing a voltage drop, parallel with the signal path. Mathematically speaking, the resistance multiplied by the capacitance is the time constant, which is proportional to the cutoff frequency and the output becomes half the input. A simple equation is frequency equals one divided by two multiplied by pi multiplied by time.

High – pass filters have a very common construction and they are extremely important in electronic design. They are usually found in everyday home appliances and a variety of other electronics. For example, high-pass filters are found in televisions, digital image processors, AM/FM tuners, tweeter speakers, etc. So to conclude, high pass filters guarantees a better quality of sound and frequency in a person’s everyday use of appliances and electronics.

Publications: None yet.
Biography: I am currently a Senior Mechanical Engineering major at Wright State University. Growing up in rural Northwestern Ohio, I spent much of my early years fascinated with farm equipment and the complexity and ingenuity that must have gone into designing these large machines. This interest eventually transformed into a hobby of learning how things work, leading me to pursue my chosen major.

Since beginning my undergraduate studies at Wright State University I have had the opportunity to explore more specific topics of study within my major and discovered an interest in thermodynamics and fluid mechanics. In addition, I have had the opportunity of an internship at Wright-Patterson Air Force Base. In my time there I have had much practical hands-on experience as well as exposure to the electrical and simulation aspects of engineering. I have also had the opportunity to study abroad in Taiwan for a summer doing research on the molding of fuel cell bipolar plates. This has all fostered my appreciation for the way the world works and the engineering discipline.

Abstract: The Wright State University High Altitude Balloon (WSU HIBAL) team is currently working towards implementing a new video system to transmit live video feed. The electronic circuit to be implemented in this system will require a heat sink to dissipate heat generated during operation. Because a typical high altitude balloon launch travels to very high altitudes, any components on board experience dramatic environmental changes. Such variation in environment can have adverse effects on the heat sink performance. Air temperatures below -50°C risk overcooling the electronics and low density air at higher altitudes reduce the effects of convective heat transfer risking overheating the electronics.

For this reason, a method of modeling heat sinks using two-dimensional numerical analysis has been investigated. A program was written to monitor temperatures based on heat sink dimensions, material properties, and environmental conditions. The model loops through conditions for multiple altitudes simulating steady state temperatures during an actual flight. The model was validated using temperature data from an actual launch as well as carefully controlled ground experiments. The program will be designed for use by future and current teams in order to properly size heat sinks for electronics.

Publications: None yet.
Peter I. Heinig

**Status:** Junior, Computer Science

**Research Topic:** Rasterization and Ray Tracing

**Advisor(s):** Tom S. Wailes, Ph.D.

**Biography:** I am currently a Junior majoring in Computer Science at Wright State University. I have enjoyed my Computer Science degree and have applied its practical applications to help various friends and family with their computer problems. I plan to obtain a master’s degree in computer science from Wright State University as well. I was born and raised in Ohio and have volunteered in my local area for places such as the Life Enrichment Center and The Adaptive Adventure Sports Coalition. My post-graduate goals consist of obtaining a job in Ohio possibly specializing in computer graphics.

**Abstract:** This project tests the efficiencies involved in rendering multidimensional objects on a computer screen using various techniques. These techniques include rasterization and ray tracing. This has practical application in the real world due to the fact video cards and processors are becoming faster and utilize more than one processing core. This project tests the efficiencies between rendering an object using only the processor in 3d compared to rendering an object using mainly the graphics card.

Various models test these two different techniques in order to account for the many different possibilities of different 3D models on a computer. Practical applications are discussed in this project which include developing insight into the possibly of rendering graphics differently than industry standards on current and future computers that utilize more than one central processing units.

**Publications:** None yet.
Status: Senior, Mechanical Engineering

Research Topic: A Study of Anode/Cathode Fabrication and Porosity Control for Solid Oxide Fuel Cells

Advisor(s): Henry Daniel Young, Ph.D.

Biography: Growing up in Bluffton, Ohio, I was always the science guy in the family. My relatives knew to give me science kits for my birthday and all broken electronic devices were forwarded to me for disassembly. It was through these that I became interested in my science and math courses in school which I excelled in. By my senior year in high school I was taking physics and college level calculus to pave the way for a major in engineering. Today, I am excited to be a senior studying Mechanical Engineering at Wright State University.

While at Wright State I have had the opportunity to apply my engineering education through several internships. Working for Applied Optimization, Nissin Brake Ohio, and AK Steel gave me exposure to R&D, design, and practical hands-on experience. This experience has fostered my interest in the design, analysis, and simulation aspects of engineering. My hard work, dedication, and experience in the engineering discipline have enabled me to obtain a full-time job at Goodrich Aircraft Wheels and Brakes in Troy, Ohio, upon my graduation.

Abstract: Solid oxide fuel cells (SOFCs) are efficient and clean operating electrochemical conversion devices that generate electricity by reacting fuel and oxidant gases at temperatures between 700 and 1000°C. SOFCs consist of an anode exposed to fuel, cathode exposed to air, and an electrolyte which separate the anode and cathode and facilitates ionic transport required for fuel oxidation. The porosity of the anode can be increased to improve fuel oxidation and fuel cell efficiency by increasing fuel flow through the anode. As a result, a study on the influence of carbon fiber (CF) as an anode additive pore former was conducted for a nickel oxide (NiO)/yttria-stabilized zirconia (YSZ) anode. To this end, a series of experiments were performed by varying the concentration of CF to investigate the effects on fabrication and porosity of the anode. A scanning electron microscope (SEM) was used to characterize the microstructure and porosity. Based on this study, a desirable CF concentration was determined. A similar study was initiated to investigate graphite as an additive pore former in an ink jet fabrication process to increase air flow through the cathode. SEM data was collected to evaluate the graphite pore former performance. In the future, a complete fuel cell will be fabricated and tested based on this work.

Publications: None yet.

Congressional District(s): 4th
Congressional Representative(s): Jim Jordan
### Michael A. Jonell

**Status:** Master's 1, Materials Mechanical Engineering  
**Research Topic:** Computational Study of NASA's NEXT Ion Engine Using a PIC Computer Model  
**Advisor(s):** Dr. James Menart

**Biography:**  
I grew up in Granville, Ohio, and began my undergraduate work at Wright State University in 2004. While working towards my degree I became involved in many student organizations and was president of an engineering organization for three of my four years, ASME for two and Tau Beta Pi for one. Thermodynamics really interested me and I thoroughly enjoyed the three courses that I took on the subject, so much so that I decided to focus on it following graduation. I was fortunate enough to hold two co-ops during my undergraduate career. My first co-op was with Kiefner and Associates, Inc in Worthington, Ohio, working on a number of different pipeline related projects and performing mechanical testing for clients. My second was with the Air Force Research Lab in Dayton, Ohio, where I performed dynamic testing on extreme environment instrumentation. I am currently pursuing a Master’s of Science in Engineering at WSU in Mechanical Engineering with a focus in thermodynamics, fluids, and plasma science.

**Abstract:**  
A code was developed to numerically analyze aspects of the NSTAR engine, and it is my goal to do the same for the larger and more powerful NASA Evolutionary Xenon Thruster (NEXT). The NEXT is the follow-up ring-cusp ion engine to the NSTAR thruster which is currently in use on the DAWN spacecraft and was successfully utilized on the Deep Space 1 mission several years ago. The computer model that has been developed was modified from XOOPIC (X-grafix Object Oriented Particle-In-Cell Code) is a detailed PIC-MCC (Particle-In-Cell Monte Carlo Collision) model of the plasma in the discharge chamber of an ion engine. This model tracks all particles in the discharge chamber in a detailed manner. This includes neutrals, first ions, second ions, primary electrons, and secondary electrons. Each of these particles is tracked in a detailed manner including the effects of many types of collisions and the effects of electric and magnetic fields on the charged particles. This approach is superior to other common approaches that make certain assumptions to shorten the computational time, at a loss in accuracy. In the NSTAR engine work, numerical results agreed well with experimental data from the NASA Glenn Research Center, and will hopefully do so when runs are completed for the NEXT engine. While computational results are still to come, as the run time for the software is on the order of months, all work up till now will be presented.

**Publications:** None yet.

<table>
<thead>
<tr>
<th>Congressional District(s):</th>
<th>12th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congressional Representative(s):</td>
<td>Patrick J. Tiberi</td>
</tr>
</tbody>
</table>
Biography: I am currently a second year Master’s student in Materials Science and Engineering at Wright State University. I received my Bachelor’s in Mechanical Engineering from Wright State University in 2007. I have been involved as an officer in the student organizations of ASME, Tau Beta Pi, and the Wright Engineering Council during my school career. It was my childhood interests in watching Star Trek and building Lego models that made me realize I wanted a career in engineering. My focus in graduate school is Renewable and Clean Energy. I hope my efforts will contribute to space exploration and help find cleaner and more efficient energy production methods. My research experience to this point has included plasma actuator flow control technology, hydrogen storage material technology, and fuel cell bipolar plate manufacturing. In addition to my engineering activities, I am a professional organist and have been playing for over fourteen years.

Abstract: Bipolar plates make up a large portion of the weight and manufacturing costs in fuel cells. Bipolar plates are metal plates that separate each membrane-electrode assembly in a fuel cell stack and contain flow channels through which the fuel flows. The need for flow channel grooves leads to high machining and manufacturing costs. The plates are metal because they need to conduct the electricity that the fuel cell produces. Electricity also flows through the gas diffusion layer (GDL) which lies next to the bipolar plate. The GDL is where chemical reactions in the fuel begin to take place. Because the GDL is separate from the bipolar plate, there is a contact resistance as the electricity flows from one to another.

The scope of my project is to research and develop a cheaper way of manufacturing a more efficient and lighter weight bipolar plate-GDL combination. This will be done by using materials such as exfoliated graphite, a binding resin, and a sacrificial polymer additive. Appropriate temperatures and pressures are important variables that are considered for a variety of materials being investigated. Conductivity measurements are taken on all resulting samples.

Publications: None yet.
Matthew D. Rippl

Status: Senior, Mechanical Engineering
Research Topic: Verification of a Hybrid Electric Unmanned Aircraft System

Advisor(s): Dr. Fred Harmon

Biography: My name is Matt Rippl, and I am a senior at Wright State University. Growing up in New Albany, a small town on the northeast side of Columbus I enjoyed a simple yet disciplined lifestyle. I went to a private Catholic school till I was in sixth grade, and then I attended New Albany Schools until high school graduation. In high school I was active in sports, I played football, swimming, and track. I was the quarterback for three years; my senior year was the first year my school made the playoffs and we were the state regional runner ups. Swimming, I was a two-time All American and was a state qualifier my senior year. Currently I am a member of the Wright State men’s swim team who, just last year, won the Horizon League Conference Championship for the second year in a row. Academically I was an honors student throughout my high school career graduating in 2005 with honors and was a member of the National Honor Society. Selecting a college was a difficult decision. I chose Wright State because of their good engineering program, and I hope to be a well-rounded student when I graduate in June, 2009.

Having completed most of my undergraduate coursework I still maintain a thirst for knowledge. Over the summer of 2008 I was fortunate enough to receive a NASA internship that allowed me to work at the Air Force Institute of Technology (AFIT). There I was able to build relationships with the professors there, and I am currently applying for a student-faculty research fellowship through the Dayton Area Graduate Studies Institute (DAGSI) with Lt. Col. Frederick D. Harmon. Hopefully, I will begin research this summer at Wright-Patterson Air Force Base and attend AFIT in the fall.

Abstract: The current use of unmanned aircraft systems (UAS) in the military is to safely investigate combat areas while maintaining the safety of American soldiers. Many small UAV’s have been developed over the years, but fuel consumption, endurance, and heat signature’s has limited their usefulness. Development of a hybrid system for UAS’s would potentially solve all these problems. By using an internal combustion engine the hybrid electric system would satisfy speed and power requirements for current missions. By placing a high efficiency motor in line with this engine, the hybrid system will achieve better fuel consumption while also reducing heat and noise signatures in order to be less detectable while in reconnaissance mode. This will improve the capabilities of unmanned systems and possibly increase their use on the frontlines to increase safety for soldier. To do this a controller designed by Frederick Harmon at the University of California Davis must be verified by setting up an experiment that will control an engine and motor in a parallel configuration.

Research will be conducted at the Air Force Institute of Technology as well as Wright State University. Components including an engine, motor, clutch, and gear box will be purchased and a test stand will be constructed. In order to switch between hybrid and engine modes an electro-magnetic clutch will be used between the engine and drive shaft. A gear box may also need to be developed to gear down the high revolution rate of the motor. Finally, a LABVIEW program will be developed to control the transition from the internal combustion engine to the electric motor.

Publications: None yet.
Megan E. Genuske

Status: Senior, Mechanical Engineering

Research Topic: Autologous Mesenchymal Stem Cell Transplantation to Improve Fascial Repair

Advisor(s): Dr. Hazel Marie

Biography: I am currently in my senior year of Mechanical Engineering at Youngstown State University and planning on graduating in May of 2009. Last summer I worked as an engineering intern at Westinghouse Electric. I worked in the Containment and Radiological Analysis Group and analyzed the containment building. I accepted a job offer in this group and will begin my career there in summer 2009. I have also done research on tissue engineering and advanced materials at Drexel University in Philadelphia, Pennsylvania. This will be my second year as a scholar with the Ohio Space Grant Consortium; last year I was the junior scholar working on the same project. I plan on getting my Master's Degree in Nuclear Engineering while working at Westinghouse, and eventually getting my Ph.D.

Abstract: It is hypothesized that using mesenchymal stem cells on an enhanced collagen matrix will increase collagen deposition and tensile strength. Thus far the research looks promising; last year’s results consistently showed the new techniques required additional energy to break the sample. Research will be the third phase of this project on autologous mesenchymal stem cell transplantation to improve fascial repair. Phase I and II dealing with the bone marrow stem cell culture (MSC) and applying the different variations of MSC’s are applied to the fascial defects induced in test rats. These rats are fifth generation inbred therefore considered like clones. This research involves Phase III; this begins with the harvesting of the abdominal fascia which will begin eight weeks after reimplantation, then dumbbell shaped segments are taken from the healed area. From these samples, the biomechanical properties of the soft tissue will be tests using an Instron Tensiometer and results will be displayed in a force-deformation curve. Load will be applied at a constant rate until disruption occurs. A 100 Newton load cell will be used; this must be installed since a much larger load cell was used in the previous experiments. The new load cell is a proper size for tests on a soft material and will add a great deal precision. In addition to a computer results, a camera will film the specimen in tension and pixels from the image in the film will be tracked to gage extension. Once all data is obtained the three ARMS of the project will be compared, analyzed, and conclusions will be made.

Publications: None yet.