Research Activities

This section includes descriptions of my research interests and work in the following areas: (1) Sustainable Building Systems, (2) Experimental Vibration and Acoustics, (3) Engineering Education Innovation, and (4) Vehicle System Modeling and Optimization. A list of relevant Master's theses and publications can be found after each description. Abstracts of these Master's theses, publication manuscripts, and posters presented at regional and national conferences can be found in subsequent sections of this portfolio.

Sustainable Building Systems

Sustainable building initiatives play a key role in reducing energy consumption and environmental impact and the role of building automation and control systems cannot be overstated. Our LEED-platinum 41 Cooper Square building offers significant research potential in the design, analysis, and control of energy efficient buildings and their building management systems. Since moving into 41 Cooper, I have been using the building as a learning laboratory and researching its many state-of-the-art features. I have met with several key contributors in the design of 41 Cooper Square, including architects, commissioning engineers,automation and control system contractors, load balancing consultants, and mechanical, electrical, and plumbing (MEP) engineering and construction firms. I continue to meet regularly with Buildings and Grounds and external vendors, including Siemens, Elite Energy, Intelligen and Smith Engineering. I have participated in several building energy and sustainability related professional development training, events and workshops.

My student research assistants and I are using the Building Management System (BMS) and developing energy analysis and fault diagnosis tools to analyze 41 Cooper Square's performance history with the intent to optimize the efficiency of specific building systems and the system as a whole. Even though Cooper Union committed to the NYC Carbon Challenge, our campus energy and carbon intensity actually increased 35% after moving into 41 Cooper Square in 2009. Since my appointment as Facilities Energy Efficiency Advisor, the trend has reversed and energy consumption has gone down 10% since 2014 (despite the fact that 2015 and 2016 were the hottest summers on record).

My students have created a Green Features website and lobby kiosk, real-time power dashboard (available on and off campus) and an energy analytics engine (only available on campus) to detect building operating and energy management issues. We are investigating existing algorithms, such as the enthalpy-based economizer control on the air-handling units and the Cooling Plant Optimization Package (CPOP), an integrated software program intended to optimize energy savings of the chiller plant, and re-tuning systems as we identify problems. We are further researching, and re-tuning as necessary, underlying HVAC components and control processes for better system integration and to reduce our energy usage and carbon footprint. We have already identified issues and worked with vendors to implement energy-saving improvements related to the operation of our air-side economizers, laboratory exhaust fans, and 150 kW and 250 kW cogeneration systems.

My students are developing analytical tools and applying artificial intelligence to the building data. My students and I have published research on using neural networks and adaptive filters to predict the energy consumption of 41 Cooper Square, to show the influence of solar variables on energy consumption, and to simulate new novel CO_2-based temperature control strategies. We have applied Computational Fluid Dynamics (CFD) to study the laboratory ventilation and exhaust fan systems. My students have applied commercial whole-building analysis software, including eQuest and EnergyPlus, to model 41 Cooper Square's energy performance and investigate better operation and control of our building systems.

I was recently awarded two NYSERDA grants. A Cooper Union Facilities Training and Curriculum Development (NYSERDA Workforce Training PON 3442, 10/1/2017, $167,671) project engages an energy consultant in developing and delivering facilities training curriculum, engages student interns in developing new building systems primers and knowledge repositories, and supports faculty and an energy consultant in developing a new Energy Efficient Building Systems course. A REV Campus Challenge Technical Assistance for Roadmaps grant (NYSERDA PON 3438, 8/29/2017, $154,000) engages student interns and an energy consultant in creating a building data historian and automated reporting tools, energy auditing and identifying energy conversation measures, and developing an energy master plan and carbon action plan. These projects aim to reduce Cooper Union's energy use and carbon emissions while reducing operating costs by building the skills of our faculty, students and facilities staff and by providing Cooper Union faculty and students the opportunity to work alongside building energy industry professionals.

This research has been presented in numerous publications, regional and national poster sessions, invited talks and panels, professional meetings, and at NYC Carbon Challenge and NYSERDA REV Challenge partnership meetings and workshops.

Refer to real-time Power Dashboard and Energy Analytics tools screenshots at the end of this section and student projects in Senior Capstone Design reports and in the Process Controls (ME352) sections.

Posters: Please refer to Posters section for posters presented at regional and national conferences.

Related Master's Thesis:

Laboratory Ventilation Energy Conservation Measures, Chong Woo (John) Han, 2016.

Development of a Calibrated Whole-Building Heat Balance Energy Model for a High-Performance Academic Building, Eric Ringold, 2016.

Investigating thermal performance of double-skin perforated-sheet façade using multi-scale approach, Woojae Kim, 2015.

Technical and Economic Assessment of Cogeneration in an Urban Academic Building, Jonathan Rodriguez, 2014. Click here for poster.

Air Dispersion Characteristics and Thermal Comparison of Traditional and Fabric Ductwork using Computational Fluid Dynamics, Sriya Adhya, 2014.

The Application of Numerical Methods and Artificial Intelligence to the Building Management System in a LEED Certified Academic Building (41 Cooper Square), Michael Sterman, 2012.

Related Publications:

Sterman, M., Baglione, M., "Simulating the use of CO_2 concentration inputs for controlling temperature in a hydronic radiant system," *Accepted to 2017 ASME International Mechanical Engineering Congress and Exposition*, November 3-9, 2012, Tampa, FL.

Sterman, M., Baglione, M., "Design of Artificial Neural Network Using Solar Inputs for Assessing Energy Consumption in a High Performance Academic Building," *Proc. of the 2012 ASME International Mechanical Engineering Congress and Exposition*, November 9-12, 2012, Houston, TX.

Experimental Vibration and Acoustics

I encourage students to take advantage of our location in New York City pursuing research projects in experimental vibration, acoustics, noise monitoring and control. Students take sound and vibration data of our HVAC equipment and evaluate the architectural acoustics of spaces in our 41 Cooper Square academic building, in The Great Hall, and in our community. I provide students with access to industry-standard data acquisition equipment (which was either donated or offered at a steep discount). I helped oversee the installation of the only anechoic chamber in NYC in our Vibration and Acoustics Laboratory. We are developing protocols and evaluating low-cost microphones and sound measurement systems for use in various applications, including speech language pathology, urban noise monitoring, architectural acoustics, and musical instrument design.

Urban Acoustic Monitoring and Deciphering the Noise Code

New York City's sound environment can be perceived as vibrant and energetic or loud and disturbing. Citizen complaints registered with the NYC 311 information/complaints line establishes noise as a major quality-of-life issue, and still not all noise issues are reported. Cooper Union students are gaining a deeper understanding of the urban sound environment, the NYC Noise Code, and how noise complaints are addressed and mitigated. Students have taken sound level measurements in a number of East Village apartments, all of which exceeded requirements set forth by the NYC Noise Code.

In 2014, I started collaborating with and co-authored a paper with the NYU Center for Urban Science + Progress (CUSP) and the Sounds of New York City (SONYC) project working to evaluate the frequency response of low-cost, acoustic sensing devices for monitoring the NYC urban sound environment. I have also developed a relationship with Charles Shamoon from the NYC Dept. of Environmental Protection Agency (EPA), responsible for developing and enforcing the NYC Noise Code, who has met with our students to advise on the NYC Noise Code and noise mitigation projects.

Evaluating Low-cost Sound Measurement Systems

This research develops test and analysis protocols for comparing measurements acquired with low-cost sound measurement systems to those obtained with calibrated equipment designed for measurement purposes. In 2014, I started collaborating with two speech language pathologists, Gaetano Fava from NYP-Columbia University Medical Center, and Prof. Gisele Oliveira from Touro College. Speech-Language Pathology focuses on the diagnosis, treatment, and post-therapy assessment of communication issues arising from diseases and disorders such as Parkinson's disease, strokes, cleft palates, and more. This relies on the recording and measurement of voice with microphones and sound level meters (SLMs) for the determination of voice perturbation metrics and vocal intensity measurements. We developed and published a frequency response measurement protocol for evaluating a microphone's suitability for voice measurement. The ubiquity of smartphones has led to the development of SLM smartphone apps. These SLM apps may provide a low-cost, portable option for sound measurement. We developed measurement and statistical analysis methods for comparing low-cost SLM apps to high-quality, precision SLMs. The experimental and analysis protocols developed in this research are applied to evaluate a selection of low-cost microphones and SLMs for voice measurement. These protocols, however, are general and can be applied to the evaluation of microphones and SLMs for a number of sound measurement applications.

In early 2017, I engaged two undergraduate researchers in a collaborative project with the Immersive Audio Group in the NYU Music Technology Program to develop a low-cost ambiosonic microphone and measurement system. These students contributed to the design of a 3D printed housing which encloses four MEMS microphone capsules. The Cooper students took the lead on design of an automated, high-resolution directivity response measurement system, which consists of a low-cost, in-house designed automatic rotating microphone mount controlled using an Arduino. The students and I contributed to a paper and will be presenting this work at the 143rd Audio Engineering Society Convention from October 18-21, 2017.

Architectural Acoustics

My students are researching the architectural acoustics of various spaces at Cooper Union and in the community. Reverberation time is an important indicator for a room's acoustics; it is the time it takes for a 60 dB sound decay. Analyzing the reverberation time can reveal which functions are most suited for a particular space and whether acoustic treatment is necessary. We've applied both the Interrupted and Impulse Methods to measure the reverberation time in our anechoic chamber, in various classrooms, and in The Great Hall and Rose auditoriums (refer to Poster in EID260 section). The Interrupted Method involves an industry standard Larson Davis omnidirectional speaker playing white or pink sound, and the Impulse Method is a low-cost method which uses a balloon-pop as a triggering sound source. A Larson-Davis 831 sound level meter is used to measure the decay of different frequency sound and to calculate the reverberation time. My students have also tested and made recommendations for low-cost auditorium acoustic treatment in an outreach project at a local public school.

Musical Instrument Analysis and Design

I have advised a number of student projects on musical instrument analysis and design projects. My students have developed an open-source program and methods to visualize the mode shapes associated with the resonant frequencies on an electric guitar and circular membranes on drums. Students have studied the acoustics and vibrational characteristics of acoustic and electric violins.

In the 2013-2014 I advised Stephanie Kwan, a Stuyvesant High School student, on her New York City Science and Engineering Fair (NYCSEF) project, *"Investigating the Suppression of Mid-Range Harmonics in Violins*." Stephanie and David Tan (ME'14) created an original experimental setup with a microphone in the anechoic chamber and an automatic bowing machine controlled with an Arduino. They tested a claim by William F. Fry that removing wood from the interior of a violin at certain locations (called Stradivari Holes #2, #3, and #4) will alter the vibrational characteristics of the violin, and suppress shrill, undesirable harmonics in the violin's sound. They collected 1/24th octave band data to determine the violin's frequency content and compared the peak amplitudes of the frequencies in the mid-range of 1500 Hz - 4000 Hz before and after the alteration to the violin's structure. The resulting 2014 NYCSEF technical report can be found in the Service Activities section.

Structural Dynamics and Experimental Modal Analysis

Structural dynamics is an area of research that studies the response of structures to applied loads. The hard disk drive in your laptop, a car driving down the road, and an office building subjected to an earthquake, are all examples of dynamic systems subjected to time-varying loading conditions.Experimental modal analysis is the process of characterizing the dynamic behavior of a structure in terms of its modal parameters, namely natural frequency, damping and mode shapes. These characteristics can be defined independently from the loads applied to the system and the response of the system. Modal analysis is used to develop a dynamic model of a structure which can be used for troubleshooting, simulation and prediction, optimization, and diagnostics, and health monitoring.

My research involves developing techniques for improved modal test measurements.Impact hammer and shaker testing are two commonly used excitation techniques in experimental modal analysis. I populated the Vibration & Acoustics Laboratory with state-of-the-art vibration testing equipment including piezoelectric accelerometers, impact hammers, electrodynamic shakers, National Instrument data acquisition hardware and a 16-channel LMS SCADAS data acquisition system (which includes over $12K worth of equipment donated from industry and a donation from the Brooks Family for the LMS SCADAS).Current work aims to more accurately develop the test specifications (as in selecting the desired frequency range), define the instrumentation (as in selecting better measurement locations), and to more realistically simulate boundary conditions with proper supports.

My approach is to have student researchers test structures that we can easily validate using simple hand calculations and progress to more complicated structures. Another area of interest is validating modal parameters and synthesizing dynamic models by correlating analytical data generated by finite element methods with experimental modal results. Finite element methods are often used in design and development but have limitations since damping is generally ignored and joints and component interactions are difficult to model. Modal models from experimental techniques can better evaluate damping but it may be difficult to simulate actual boundary conditions. Correlating analytical FEA and experiential modal data has significant potential in developing better dynamic models.

Students have applied these experimental techniques in my Advanced Vibration (ME401) course. Some ME301 students also apply modal analysis for their course projects. Example past projects include finding the sweet spot for a tennis racquet or baseball bat. Example structural dynamics and modal analysis projects can be found in the ME401 and ME301 sections and on engfac.cooper.edu/melody/591.

Related Publications:

Oliveira, G., Fava, G., Baglione, M., Pimpinella, M., "Mobile Digital Recording: Adequacy of the iRig and iOS device for Acoustic and Perceptual Analysis of Normal Voice," *Journal of Voice,* March 2017, Vol. 31(2), 236-242.

Fava, G., Oliveira, G., Baglione, M., Pimpinella, M., Spitzer, J., "The Use of Sound Level Meter Apps in the Clinical Setting," *American Journal of Speech-Language Pathology,* Feb. 2016, Vol. 25, 14-28.

Mydlarz, C., Shamoon, C., Baglione, M., Pimpinella, M., "The design and calibration of low cost urban acoustic sensing devices," *10th European Congress and Exposition on Noise Control*, May 31-June 3, 2015, Maastricht, Netherlands. *Best Paper Award.*

Zalles, G., Kamel, Y., Anderson, I., Lee, M.Y., Neil, C., Henry, M., Cappiello, S., Mydlarz, C ., Baglione, M., and Roginska, A., "A low-cost, high-quality MEMS ambisonic microphone," *Accepted to143rd Audio Engineering Society Conference*, October 18-21, 2017, New York, NY.

ENGINEERING EDUCATION INNOVATION

Undergraduate Engineering Education

How to best prepare engineering students to tackle societal challenges of today and tomorrow remains a pivotal challenge. Engineering faculty are challenged with delivering an appropriate balance between technical knowledge and interdisciplinary breadth while keeping pace with modern technology and tools, and simultaneously teaching professional skills, such as problem-solving, communication, teamwork, and life-long learning.[1,2] My interest in engineering education innovation research stems from a desire to constantly evaluate the curricular content, and my teaching methods, in an effort to best prepare engineering graduates to make meaningful professional and societal contributions. I recognize that curricular innovations should be grounded in established research into *How Students Learn*[3] and evaluated using systematic assessment processes that measure progress and are used for continuous improvement.

My goals include investigating, designing, implementing, and evaluating integrated curricular structures and active learning pedagogies. I am currently developing inductive teaching methods, where new information is presented in the context of situations and problems to which the student can relate.[4] As part of my NSF Transforming Undergraduate Education in Science, Technology, Engineering, and Math (TUES) "Building Sustainability into Control Systems Courses" grant (DUE #1044830, $107,884), I am using our new academic building as a context to introduce inductive learning of control systems and weave in the importance of sustainable building systems. I give students tours of our HVAC mechanical rooms and show them the Building Management System and energy monitoring tool. Then students have to analyze system processes in terms of inputs and outputs and how system level components achieve high-level goals while minimizing energy consumption and environmental impact. I designed new curricular material for process control experimental rigs and created a new Process Control Laboratory (ME352) course. Instead of having students follow traditional step-by-step laboratory procedures, I present them with real-world engineering scenarios where they have to model the system and modify its performance to achieve desired specifications.I am sharing my findings with my faculty colleagues, many of whom have also leveraged my work and are now using the building or experimental rigs as a context to introduce concepts and problems from their courses, such as fluid dynamics, thermodynamics, and heat transfer.

I am also incorporating hands-on, experiential teaching methods by integrating new laboratories and real-world projects into the mechanical engineering curriculum. I integrated new projects in my vibrations and acoustics courses, where students approach realistic, open-ended engineering problems and acquire hands-on experience with vibration and acoustic data acquisition and analysis. I am also exploring collaborative learning by having senior and graduate students work with undergraduate students mirroring the professional relationships they will encounter in their careers. More details on the new teaching methods I implemented in specific courses can be found in the Teaching Activities sections of this portfolio.

In an effort to systemically evaluate new curricular innovations, I implemented the Student Assessment of Learning Gains (SALG)[5] survey in my courses. I am contributing to the implementation of more systematic assessment process and have helped a number of faculty both in the ME Dept. and outside implement the SALG survey. Sample SALG survey results can be found in the ESC251, ME351/ME352, ME301, ME401, and ME393/ME394 course sections.

My commitment to engineering education innovation is further evident by my participation in "Adding Sustainability to Engineering Education" and "Assessing Hands-On Learning" workshops (both attended with NSF funding). I am contributing to the engineering education knowledge base on a national level by presenting at ASME and ASEE Engineering Education conference sessions. I applied for and was accepted to attend the 2013 NSF TUES/CCLI PI Conference and the 2015 ASEE NSF Grantees' Poster Session participating in poster sessions, discussion groups, and networking opportunities with NSF program officers and other faculty engaged in improving undergraduate education. I also stay informed of curricular innovations at other schools by serving as a reviewer of engineering education publications, electronic sustainable engineering educational material submissions, and by serving on NSF Transforming Undergraduate Education in STEM (TUES) review panels. I led writing and submission of a NSF survey on "Creating a Culture of Systematic Innovation in Engineering Education" which culminated in an ASEE *Innovation with Impact* report.[6] As coordinator for our Senior Capstone Design course and as the ME Department Chair, I developed and continue to refine a ME Senior Capstone Design evaluation rubric, ABET outcomes matrix and templates for systematically assessing and evaluating our program.

PreK-12 Science, Technology, Engineering, and Mathematics (STEM) Education

Enhancing PreK-12 STEM teaching and learning has significant potential to increase interest in STEM careers and close STEM achievement gaps. Studies have shown that children are more likely to excel in STEM subjects if they are exposed as early as PreK[7], however, there is very little formal STEM curriculum at the early childhood level. Achievement gaps are even greater among the economically disadvantaged, underrepresented minorities, and students with disabilities.[8,9] Technology can be used as a playful conduit to introduce STEM concepts in a meaningful way.

I initiated an Interactive Light Studio project at the American Sign Language and English Lower School (P.S. 347). P.S. 347 is New York City's only public school for the deaf, hard of hearing, and children of deaf adults integrating deaf and hearing impaired children with hearing children in a collaborative team teaching environment. My students and I wrote five Diversity Action Grants to the American Society of Mechanical Engineers (ASME), which were awarded in 2011-2016 totaling $13,000 for creating interactive installations and STEM outreach activities (refer to Proposals and Service Activities section).

In 2013, this project was featured on Time Warner Cable News and nationally on the *Connect A Million Minds* series. I co-authored with students two conference papers in the ASME K-12 Outreach Session and publicized this project in numerous articles, including the Huffington Post and Scientific American (refer to CV and Media and Articles sections).

I am also very much interested in PreK-12 STEM outreach that addresses recruitment and retention of a diverse engineering student population. Given Cooper Union's location in NYC, opportunities exist for faculty mentoring and engaging PreK-12 students at high-needs schools in outreach sessions and summer projects, which are proven ways to help high needs and underrepresented groups persist in engineering, while at the same time identifying potential talent to recruit to Cooper Union.

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3. National Research Council (NRC). 2005. How Students Learn: History, Mathematics, and Science in the Classroom. Washington DC: National Academies Press.
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6. *Innovation with Impact: Creating a Culture for Scholarly and Systematic Innovation in Engineering Education*, American Society of Engineering Education, June 1, 2012.
7. Banko, W., Jabot, M.E., Molloy, P.B., Serotsky, A., Tulloch, B., (2010, July) "Starting a Science Education." *Education Week*. 27 July 2010.
8. National Academy of Sciences, National Academy of Engineering and Institute of Medicine. (2011). *Expanding Underrepresented Minority Participation: America's Science and Technology Talent at the Crossroads.* Washington, DC: National Academies Press.
9. Cawthon, S.W. (2007). "Hidden Benefits and Unintended Consequences of No Child Left Behind Policies for Students Who Are Deaf or Hard of Hearing." *American Education Research Journal*, 44 (3) 460-492.

Related Publications:

Baglione, M., "Building Sustainability into Control Systems: A New Facilities-Based and Hands-On Teaching Approach," 122nd ASEE Annual Conference Paper #13199, June 14-17, 2015, Seattle, WA.

Baglione, M., del Cerro, G., "Building Sustainability into Control Systems: Preliminary Assessment of a New Facilities-Based and Hands-On Teaching Approach," *Proc. of the 2014 ASEE Zone 1 Conference*, Apr. 3-5, 2014, Bridgeport, CT. *Nominated for Best Professional Paper Award.*

Baglione, M., Caubel, J., "Developing Undergraduate Engineering Curriculum Material using the Heating, Ventilation, and Air Conditioning and Building Management Systems of a High Performance Academic Building," *Proc. of the 2012 ASME International Mechanical Engineering Congress and Exposition*, November 9-12, 2012, Houston, TX.

Baglione, M., Short, D., Correll C., Tan, D., "Developing Installations and Activities for an Interactive Light Studio at the American Sign Language and English Lower School," *Proc. of the 2012 ASME International Mechanical Engineering Congress and Exposition*, November 9-12, 2012, Houston, TX.

Baglione, M., Wong, N., Clevenson, H., O'Meara, B., Baker, J., "Creating an Interactive Light Studio for the American Sign Language and English Lower School," *Proc. of the 2011 ASME International Mechanical Engineering Congress and Exposition*, November 11-17, 2011, Denver, CO.

Baglione, M., "Incorporating Practical Laboratory Experiments to Reinforce Dynamic Systems and Control Concepts," *Proc. of the 2009 ASME International Mechanical Engineering Congress and Exposition*, November 13-19, 2009, Lake Buena Vista, FL, Vol. 7, pp. 391-395.

Posters: Please refer to Posters section for four Engineering Education posters presented at regional and national conferences.

VEHICLE SYSTEMS MODELING AND OPTIMIZATION

Optimizing the vehicle system is essential for achieving higher fuel efficiency. My research addresses the need to better understand energy demand from a vehicle subsystem standpoint and tackles the challenge of optimal hardware and control system design.

I apply hybrid semi-empirical and analytical approaches that combine first principles with detailed component speed and load data and a MATLAB/Simulink-based Energy Analysis Tool to analyze the vehicle energy supply and demand over specified drive cycles. This energy analysis methodology can account for the instantaneous and accumulated vehicle subsystem energy usage and reveal prevailing fuel economy factors for city and highway driving. This work was used by Oak Ridge National Laboratory to populate the Environmental Protection Agency's (EPA) fueleconomy.gov website and the International Energy Agency (iea) *Technology Roadmap: Fuel Economy of Road Vehicles* report.

I developed a reverse dynamic optimization methodology for optimal powertrain integration and control design. A reverse tractive road load demand model developed in MATLAB/Simulink propagates the required wheel torque and speed derived from vehicle speed and road grade through the powertrain system to determine the required fuel flow for all possible states within the hardware constraints. For this methodology I formulate the control problem as a multi-stage, multi-dimension decision process, where dynamic programming is applied to find an optimal control policy that minimizes the accumulated fuel flow over a drive cycle. This research resulted in U.S. Patent #8,050,856, "Methods and Systems for Powertrain Optimization and Improved Fuel Economy." In 2012, this patent was selected by Chrysler senior management out of 244 U.S. patents approved between 2007 and 2012 for the prestigious Walter P. Chrysler Technology Award. Using this methodology, I developed a Powertrain Matching Analysis Tool, which is currently used by FiatChrysler to optimize future vehicle programs (refer to external letter of support from FiatChrysler VP of Global Powertrain).

I continue to meet with Chrysler senior executives regularly to keep current about automotive research and development trends. (As an aside, as a result of my continued networking, FiatChrysler has begun recruiting at Cooper Union. Senior executives and employees attended the 2016 Career Fair and I coordinated lab tours, meetings with students and a luncheon. Since then, Chrysler has made offers to and hired a number of Cooper Union students.)

My current research involves developing vehicle system models and tools for predicting and optimizing powertrain configurations and control strategies for advanced vehicular technology, such as continuously variable transmissions and hybrid electric vehicles. New powertrain technologies increase the degrees of freedom associated with vehicle systems, and as such, new control algorithms are necessary for these systems to perform optimally. Interactive and robust real-time optimization and control capabilities need to be developed. I advised two Master's thesis related to electric and hybrid electric vehicle modeling and optimization. I also advised three vehicle systems undergraduate research projects and advised nine Senior Capstone Design vehicle optimization projects. In 2014, I presented this research at the *3rd International Conference on Energy Efficient Vehicles* and as a guest lecturer at the Technical University of Dresden in Germany.

Related Publications:

Baglione, M., Duty, M.J., "A Dynamic Programming Based Simulation Tool for Optimizing Vehicle System Efficiency," *3rd International Conference on Energy Efficient Vehicles (ICEEV 2014)*, June 24-25, 2014 Dresden, Germany.

Kanber, B., Baglione, M., "Developing an Extensible and Concise Simulink Toolset for Hybrid Vehicle Modeling and Simulation," *SAE Technical Paper 2011-01-0755.*

Baglione, M., Duty, M., "Development of a Powertrain Matching Analysis Tool," *SAE Technical Paper 2010-01-0490*, *Awarded SAE Engineering Meetings Board Outstanding Oral Presentation Award.*

Baglione, M., Duty, M., "Reverse Dynamic Optimization of Variable Displacement Engine Operation and System Integration." *Proc. of the 2008 ASME Dynamic Systems and Control Conference*, October 20-22, 2008, Ann Arbor, MI.

Baglione, M., Duty, M., "Development of Reverse Dynamic Optimization Methodology for Optimal Powertrain Integration and Control Design," *Proc. of the ASME 2008 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference*, August 3-6, 2008, Brooklyn, NY.

Baglione, M., Duty, M., Pannone, G. "Vehicle System Energy Analysis Methodology and Tool for Determining Vehicle Subsystem Energy Supply and Demand," *SAE Transactions Journal of Passenger Cars: Electronic and Electrical Systems*, Vol. 116, No. 7, 2008.

Baglione, M., Duty, M., Ni, J., Assanis, D., "Reverse Dynamic Optimization Methodology for Maximizing Powertrain System Efficiency," *Proc. of the 5th IFAC Symposium on Advances in Automotive Control*, August 20-22, Monterrey, CA, Vol. 5, No. 1, 2007. Invited as plenary presentation.

Related Master's Theses:

Vehicle Simulation Analysis and Hardware-in-the-Loop Framework for Electric Vehicle Design and Optimization, David Hahm, 2012.

Developing an Extensible and Concise Simulink Toolset for Hybrid Vehicle Modeling and Simulation, Burak Kanber, 2011.