UNIVERSITY of DAYTON
School of Engineering

ARC 2017

Research for the Common Good

OCTOBER 10–12, 2017

Academic Research Colloquium for Engineering Ph.D. Candidates

My fellow researchers,

On behalf of the University of Dayton and the School of Engineering, I would like to welcome you to Dayton and our annual Academic Research Colloquium (ARC).

In keeping resonance with universal needs, ARC 2017 focuses on research for 'The Common Good' to kindle collective conversations about global issues of our time. Our hope is that we've only just begun, and that our discussions will continue and will ignite national and international beneficial transformations.

The 20 students selected for ARC 2017 represent a variety of disciplines from our nation's distinguished universities, each with their unique approach of addressing research for 'The Common Good.' From the design of new avenues to interrogate cancer cells and better diagnose and characterize the disease to materials for wear-resistance applications, the participants of ARC 2017 bring a plethora of ideas to our forum to address common ground.

Our University was founded in 1850 on land that was purchased by French Marianists. Since the 19th century, Dayton has been historically a hotbed of entrepreneurs: the Wright brothers, inventors of the airplane; Charles Kettering, inventor of the electric self-starter for cars and founder of Dayton Electric Company; James Ritty, inventor of the cash register; John Patterson, developer of the cash register and founder of the National Cash Register Company (NCR); and Joe Desch, one of our early graduates in electrical engineering, and instrumental, while working at NCR, in decoding German Enigma machine messages to help end World War II.

As a top-tier research University, we follow our Marianist traditions of educating, and continuing to educate, the whole person, faculty, staff and students, in a collaborative, diverse and inclusive setting, where all voices are heard. According to our University president, Dr. Eric Spina, we are on a "path to becoming known as 'The University for the Common Good.'"

Following our University motto – Learn. Lead. Serve. – and our President's message, we are committed to creating an open, welcoming and inclusive campus to empower and challenge engineers and scientists to reach beyond their limits and advance research in an entrepreneurially inventive and innovative manner for 'The Common Good.'

We are excited to host ARC 2017 at the School of Engineering and to share our teaching and research facilities, student and faculty research, and future prospects for collaboration with our colleagues in academia and industry.

Cordially,

Eddy Rojas Molina

Eddy Rojas
Dean, School of Engineering
University of Dayton

Schedule

TUESDAY, OCTOBER 10, 2017

4:30 – 5:45 p.m.	Arrival and check-in, Marriott at The University of Dayton (1414 S. Patterson Blvd.)
5:45 p.m.	Transportation to dinner venue
6:00 – 8:00 p.m.	Dinner at Coco's Bistro (250 Warren St.)
8:00 p.m.	Transportation to hotel

WEDNESDAY, OCTOBER 11, 2017

Before 8:00 a.m.	Breakfast at Marriott UD
8:00 a.m.	Transportation to Kettering Labs
8:15 – 8:30 a.m.	Welcome to UD and Kettering Laboratories (KL 505)
8:30 – 9:45 a.m.	Presentation session #1 (KL 505)
9:45 – 10:15 a.m.	Coffee Break & Networking
10:15 – 11:30 a.m.	Presentation session #2 (KL 505)
11:30 – 11:45 a.m.	Transportation to River Campus
11:45 a.m. – 12:45 p.m.	Lunch (M2265)
12:45 – 1:45 p.m.	Workshop # 1 - Effective Faculty Job Applications and Interviewing (M2265)
1:45 – 2:00 p.m.	Break
2:00 – 3:00 p.m.	Workshop #2 - Effective Proposal Writing (M2265)
3:00 – 3:10 p.m.	Break
3:10 – 4:00 p.m.	University of Dayton Research Institute (UDRI) Overview and Tour
4:00 p.m.	Transportation to hotel
4:15 – 5:45 p.m.	Extended break at hotel
5:45 p.m.	Transportation to Kennedy Union
6:00 – 8:00 p.m.	Networking Social with ARC Participants, UD Faculty and Administration (Torch Lounge, Kennedy Union)
8:00 p.m.	Transportation to hotel

THURSDAY, OCTOBER 12, 2017

Before 8:00 a.m.	Breakfast at Marriott UD
8:00 a.m.	Transportation to Kettering Labs
8:15 – 8:30 a.m.	Welcome Back!
8:30 – 10:00 a.m.	Presentation session #3 (KL 505)
10:00 – 10:30 a.m.	Coffee Break & Networking
10:30 – 11:45 a.m.	Presentation session #4 (KL 505)
11:45 a.m. – 12:00 p.m.	Walk to lunch
12:00 – 1:00 p.m.	ARC closing lunch (Presidential Suite - KU 316)
1:00 p.m.	Transportation to hotel or airport

ARC 2017 Research Titles and Abstracts

WEDNESDAY, OCTOBER 11, 2017, 8:30 – 9:45 AM

PRESENTATION SESSION #1

Session Moderator: Erick S. Vasquez, Ph.D., Assistant Professor, Chemical and Materials Engineering

Colin Hisey, Biomedical Engineering, The Ohio State University
Microfluidic Devices for Cancer Diagnostics and Characterization

Microfluidic devices provide a new avenue to interrogate cancer cells and better diagnose and characterize the disease's progression on an individual patient level. The development of two devices will be presented, one which seeds individual cancer cells onto biomimetic migratory substrates and another which isolates cancer exosomes from serum.

Tamara Lozano, Chemical Engineering, Villanova University
Predictive Catalyst Design by Scaling Relations and Volcano Plots on Alloy Nanoparticle Decorated Graphene

In this work, we perform DFT Calculations to study the effect that different dopants have on the electronic structure of graphene (2D hexagonal carbon sheets) and predict the catalytic activity on different reaction pathways when using graphene as a catalytic support for binary alloy nanoparticles in the oxygen reduction reaction.

Baiping Ren, Chemical and Biomolecular Engineering, The University of Akron
Molecular Design Principle for Generic Amyloid Inhibitors

Given the continuing rise of human life expectancy and the lack of preventive and curative therapeutic approaches to combat Alzheimer disease (AD) and other amyloid diseases, here we combined computational screening, data mining and experimental validations to develop a series of amyloid inhibitors against AD and type 2 diabetes.

Jessica Schiltz, Aerospace and Mechanical Engineering, University of Notre Dame
Additive Manufacturing of Materials for Wear-Resistance Applications

Additive manufacturing (AM) presents significant opportunities to process ceramic feedstock, but AM material tribology remains underdeveloped due to challenges associated with producing fully-dense parts. Given that wear performance is critical in the longevity of articulating surfaces, this work evaluates oxide and nitride ceramics processed with various AM technologies.

Sarah Watzman, Mechanical Engineering, The Ohio State University
Berry Curvature-Induced Huge Anomalous Nernst Effect in the Absence of Magnetic Field in the Time-Reversal Symmetry-Breaking Weyl Semimetal YbMnBi2

YbMnBi2, a Weyl semimetal, yields huge conversion between an applied temperature gradient and a perpendicularly measured voltage. This is driven by Berry curvature of the electronic band structure, obviating the conventional need for an externally applied magnetic field. This transverse energy conversion coefficient vastly exceeds that of commercial thermoelectric materials.

WEDNESDAY, OCTOBER 11, 2017, 10:15 – 11:30 AM

PRESENTATION SESSION #2

Session Moderator: Kellie R. Schneider, Ph.D., Assistant Professor, Engineering Management, Systems and Technology

Johnson Fadeyi, Industrial and Systems Engineering, Wayne State University
A Framework for Product Modularity Decisions Support for Product Service SystemRemanufacturing Synergy

Currently, about 80 percent of manufactured products end as waste. This research develops an optimization model that identifies product configurations that enhance product service system remanufacturing business offering. Comparative advantages of the viable alternatives are also determined. The study provides a modular product architecture decision guide that mitigates materials extraction and product disposals.

Lin Lu, Industrial and Systems Engineering, Auburn University
Advancing Safety Surveillance among Manufacturing Workers

Fatigue is a known precursor to negative health outcomes and has significant short/long-term implications. In this talk, we present the results of our recent survey, data-driven fatigue prediction model and knowledge base to illustrate the prevalence, symptoms, main drivers, detection and intervention of worker fatigue in manufacturing.

Hans Ottosson, Mechanical Engineering, Brigham Young University
Handling the Complexity and Uncertainty when Designing for the Resource Poor

Working in global development isn't for the faint-hearted. It is a complex area filled with uncertainties. How do we know if our products have an impact? We are therefore creating a product development framework for social good with a heavy emphasis on assessing social impact of products and handling uncertainty.

Zahra Sedighi-Maman, Industrial and System Engineering, Auburn University
A Data Driven Framework to Identify the Critical Variables and to Predict the Fatigue in Manufacturing Workers Using Wearable Sensors

Fatigue is an important safety concern in manufacturing. This has motivated researchers to investigate data mining methods to develop a model to detect the fatigue before happening. The goal is to gain hidden and useful information from monitoring the workers by employing data mining techniques, which help to prevent injury occurrence.

THURSDAY, OCTOBER 12, 2017, 8:30 – 10:00 AM

PRESENTATION SESSION #3

Session Moderator: Emily Fehrman Cory, Ph.D., Faculty of Practice of Innovation and Entrepreneurship, Mechanical and Aerospace Engineering

Cara Albright, Water Resources Engineering, Villanova University
Urban, Strategic and Resilient: A Hydrologic Analysis of Dynamic Rain Garden Performance in Philadelphia, Pennsylvania

Analysis of continuous monitoring data from urban green infrastructure (GI) systems focused on water cycle component interactions that are used to establish dynamic GI nature. Performance across temporal scales shows that GI routinely capture small storms and large events. Urban GI systems are inherently flexible, contributing to flood management and resilience.

Elyse Stachler, Civil and Environmental Engineering, University of Pittsburgh
Development of crAssphage-Based PCR Methods for Source-Tracking of Human Fecal Pollution in Environmental Waters

Communities rely on environmental water monitoring of fecal pollution to protect the public during recreational activities as well as protecting waters used for drinking sources or food production. Novel viral-based assays were developed as human-specific markers that are easily detected in polluted environmental waters.

Saad Qureshi, Mechanical and Aerospace Engineering, University of Dayton
Saving Lives through Aerial Fire Suppression: From Aerodynamic breakup to a Ground Coverage Predictability Model

The University of Dayton is deriving a model for the United States Department of Agriculture – Forest Service, USDA-FS, to better enable a swift and accurate aerial retardant drop. Precise modeling is critical to controlling wildfires, which ultimately result in protecting lives and property.

Sarah Krug, Electro-Optics and Photonics, University of Dayton
Adaptive Computational Phase Correction of a Partially Coherent Multi-Aperture System

Multi-aperture systems typically require complex hardware to phase the apertures. Increasing relative aperture spacing in the exit pupil allows for computational phasing. Results shown demonstrate increased resolution using this approach to phase multiple apertures.

David Lombardo, Electro-Optics and Photonics, University of Dayton
An Integrated Photonics Biological Sensor Platform for Clinic-On-A-Chip Applications

We are developing a photonic chip on a silicon platform that can sense the presence of molecules using an extremely sensitive optical e_ect known as evanescent_eld sensing. This will allow for robust and inexpensive chemical and biological sensors that can one day be integrated into every day electronics.

Ali Mohamed, Electrical Engineering, University of Dayton
Investigation of Signal and Image Transmission through MVKS Turbulence with and without Chaos

In our research, information is embedded inside an electromagnetic (EM) carrier and imaged via propagation through anisoplanatic phase turbulence using diffraction, MVKS and the Hufnagel-Valley altitude model. The (unmodulated) EM carrier is imaged via standard carrier modulation and also a transparency/lens combination. Furthermore, mitigation of image/signal distortion is explored using an RF chaotic carrier.

THURSDAY, OCTOBER 12, 2017, 10:30 – 11:45 AM

PRESENTATION SESSION #4

Session Moderator: Allison Kinney, Ph.D., Assistant Professor, Mechanical and Aerospace Engineering

Leigh Allin, Biomedical Engineering and Mechanics, Virginia Polytechnic Institute and State University
Slip Recovery Training Improves Balance Recovery Ability Following Laboratory-Induced Slips

This study evaluated the efficacy of two practical, cost-effective methods for slip recovery training in improving balance recovery after slipping. Both training methods resulted in a higher number of recoveries following unexpected laboratory-induced slips while walking and exhibited improved proactive and reactive control of slipping compared to a control group.

Rachel Baker, Mechanical Engineering, The Ohio State University
Patient Outcomes of Total Knee Replacements: Investigating the Effects of Muscle Forces, Implant Type, and Surgical Technique

Up to 27 percent of patients have functional deficits after total knee replacement (TKR). Determining how muscle forces, implant design and surgical technique together affect functional TKR outcomes provide surgeons and physical therapists with actionable targets for TKR treatment with the end-goal of better quality of life for TKR patients.

Jordan Craig, Bioengineering, University of Kansas
Quantifying Gait Stability Based on Body Segment Coordination Relationships Measured with Wireless Sensors

Persons with multiple sclerosis have a high risk for falls, possibly due to altered coordination between trunk and foot movement variability, which we have shown to be different compared to healthy adults during normal walking. The goal of this project is to determine how relationships between segments relate to stability.

Omid Heidari, Mechanical Engineering, Idaho State University
Upper Limb Kinematic Characterization for Augmented Reality Rehabilitation

This research is part of a project aimed to develop and test a novel augmented reality wearable system for the training of the human arm of post-stroke patients. Fast, accurate and customized modeling and embedding of the arm kinematics is essential for successful perception and training.

Anne Koelewijn, Mechanical Engineering, Cleveland State University
Predictive Simulations of Human Gait and Their Application in Prosthesis Design

Walking can be theoretically predicted by finding a human movement trajectory that requires minimal energy. Currently, predictive simulations cannot predict important features of normal gait. I aim to improve methods to obtain more realistic predictions and to apply predictive simulations to help understand transtibial amputee gait and to improve prostheses.

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INTELLECTUAL PROPERTY
DONE PROPERLY

WHAT'S IN STORE FOR THE FUTURE OF ENGINEERING IN HIGHER EDUCATION? Integration of collaboration between top universities and visionary companies is our momentum.

At the University of Dayton, two Fortune 500 companies built research facilities right on campus.

In 2013, GE Aviation completed a $53 million Electrical Power Integrated Systems Center, where our faculty and graduate and undergraduate students work to create advanced electrical power systems for aircraft, longer-range electric cars and smarter power grids. In April 2016, Emerson Climate Technologies opened its $35 million innovation center on University property, where we work to increase heating, air conditioning and refrigeration efficiency, promote sustainability, and improve system connectivity.

Globally, faculty, students and professionals take courses, conduct research and immerse in experiential learning at the UD-China Institute. The Institute is one of almost 30 universities with a presence in China at the Suzhou Dushu Lake Science and Education Innovation District (SSED), also known as the Higher Education Town.

The University's ETHOS Center was created to take engineering curriculum beyond the classroom, even beyond this country. Graduate and undergraduate students engage in service-learning experiences and technical projects around the globe. They've worked in twenty countries on 4 continents and partnered with in-country hosts who sponsor our projects, enable authentic cultural immersions and provide local perspectives — engagement and commitment to a common mission and vision.

Whether we're working with companies or communities, the University of Dayton has always read the signs of the times and acted boldly for the future. It's a part of our Catholic, Marianist mission. It's how we continue to change to meet the needs of our world and research for 'The Common Good.'

UNIVERSITY of DAYTON

A TOP-TIER CATHOLIC RESEARCH UNIVERSITY

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