Faculty Research Conference Schedule

Wednesday, November 8, 2023 from 9 am - 7 pm

8:30 am - 5:00 pm - Registration Check In - Registration Desk
9:00 am - 7:00 pm - Faculty Research Displays - Foyer

Faculty Research Presentations

9:00 - 9:50 am

Session 1 - Room 210

Dr. Mohammad Jafari, Robotics Engineering, Columbus State University
Robust Tracking Control of a Class of Dynamical Systems Using a Simple Learning Approach

Abstract for Dr. Mohammad Jafari
Abstract: Robust tracking control of dynamical systems is of paramount importance in many disciplines including but not limited to Robotics, Control, Power, and Biological systems. There are many learning-based and nonlinear methods introduced in the literature that have several benefits, such as handling uncertainties, unmodeled dynamics, and disturbances. However, implementing these approaches in real-time are challenging because they are mostly computationally expensive. In our recent work published in Electronics Journal, entitled "A Simple Learning Approach for Robust Tracking Control of a Class of Dynamical Systems"[1], we generalize the fundamental steps presented in our other work [2, 3] for the design of a simple learning (SL) control strategy for the trajectory tracking of a class of dynamical systems. We provided stability proof for the closed-loop nonlinear system and performed multiple experimental and numerical simulations to demonstrate the effectiveness of the developed control law.

Co-author: Mahmut Reyhanoglu

Dr. Mahmut Reyhanoglu, Robotics Engineering, Columbus State University
Nonlinear Control of Mechanical, Aerospace, and Robotic Systems

Dr. Mahmut Reyhanoglu
Abstract: This talk summarizes my research activities over the past several years. The talk is organized into three parts. The first part gives an overview of important research results on the dynamics and control of nonholonomic dynamic systems, i.e., dynamic systems satisfying nonintegrable kinematics relations, as well as underactuated mechanical systems satisfying nonintegrable acceleration relations. Control design methods for such systems include the use of sigma processes and geometric phases. The results are applied to mechanical systems with nonholonomic constraints, such as wheeled mobile robots, and to aerospace and mechanical systems with nonholonomic motion invariants including internally actuated space robots. The results are also applied to underactuated space and marine vehicles and underactuated robot manipulators.

The second part of the talk briefly mentions more recent research activities that include nonlinear control of unmanned aerial vehicles (UAVs), thermoacoustic oscillations, and higher order nonholonomic systems, such as robotic systems that are subject to jerk and snap constraints. The effectiveness of these research results is demonstrated through computer simulations and animated movies of controlled motions of the above-mentioned physical examples.

Finally, the third part of the talk is on the most recent research activity that has been carried out at CSU. This research focuses on the robust tracking control problem for a class of uncertain nonlinear dynamical systems subject to unknown disturbances. A robust trajectory tracking control law is designed via a simple learning-based control strategy. In the developed control law design, the cost function based on the desired closed-loop error dynamics is minimized by means of gradient descent technique. A stability proof for the closed-loop nonlinear system is provided based on the pseudo-linear system theory. The learning capability of the developed robust trajectory tracking control law allows the system

to mitigate the adverse effects of the uncertainties and disturbances. The computer simulation results for a 2-DOF helicopter test bed and a planar PPR (Prismatic-Prismatic-Revolute) robot are presented to illustrate the effectiveness of the developed control law.

10:00 - 10:50 am

Session 2 - Room 210

Dr. Carlos Almada, Mathematics, Columbus State University
The Conformal Wave Equation on a Conformally Flat Lorentzian Manifold

Abstract for Dr. Carlos Almada
Abstract: The conformal wave equation on any Lorentzian manifold is a wave equation which is invariant under conformal changes of the metric. When the metric is conformal to the metric of the flat Minkowski space, we show how to solve the conformal wave equation in terms of the usual wave equation on Minkowski space. We then apply this result to the case of the conformal wave equation on a flat Friedmann-Robertson-Walker (FRW) cosmological model.

Dr. Yesem Kurt Peker, TSYS School of Computer Science, Columbus State University
Securing Building Fault Detection for Ft. Benning

Abstract for Dr. Yesem Kurt Peker
Abstract: Today, many businesses are moving toward leveraging cloud platforms like Amazon Web Services and Microsoft Azure to host their applications and dynamically scale resources as business needs change. Cloud platforms allow customers to offload the responsibilities of maintaining server racks, updating hardware, and keeping systems up to date to the cloud service provider. This allows the customers to focus on creating their product.

US Ignite, a Department of Defense (DoD) contractor, contracted CSU to develop an application for building fault detection (BFD) to be deployed at Ft. Benning that is compliant with DoD's Cybersecurity Maturity Model Certification (CMMC) 2.0. BFD aims to achieve energy efficiency via real-time tracking of electricity consumption and occupancy in FB buildings. The project is designed to be deployed on the Azure Cloud with energy consumption data extracted and processed in real-time using Machine Learning. The security component of the project involves the security assessment of the application for compliance with CMMC 2.0. In this presentation we will share our work on this project with a focus on the security component.

Co-authors: Riduan Abid, Shamim Khan, Luka Wilmink, Jonathan Co, Ryan Zimmerman, Thomas Merino, Kaleb Horvath, Austin Lee

11:30 - 11:50 am

Session 3 - Room 210

Dr. Mohammad Jafari, Robotics Engineering, Columbus State University
Closed-loop control of biological systems: merging machine learning and bioelectronics

Abstract for Dr. Mohammad Jafari
Abstract: The majority of physiological processes are regulated by homeostasis- a stable dynamic equilibrium that is obtained with a biological control loop that includes sensors and actuators. Disease and aging result in diminished, slower, and often broken homeostatic control loops. Bioelectronic devices interface human-made technology with biological systems and enable measurement and control of specific processes with sensors and actuators that have the potential to affect homeostatic control loops. In our recent work published in Cell Reports Physical Science, entitled "Merging machine learning and bioelectronics for closed-loop control of biological systems and homeostasis" [1], we propose that machine learning can enhance the scope of bioelectronics by providing real-time processing of sensor and actuator data. Potential applications of machine learning-driven bioelectronics can greatly impact bioelectronic medicine and precision medicine in repairing broken homeostatic loops.

Co-authors: Marcella Gomez, Marco Rolandi, Giovanny Marquez, Harika Dechiraju

1:00 - 1:50 pm

Session 4A - Room 210

Dr. Kerri Taylor, Chemistry, Columbus State University
Development and Evaluation of Audible Titration Modules: Chemistry Learning for Visually Impaired Students

Abstract for Dr. Kerri Taylor
Abstract: Chemistry is central to everyday life and ubiquitous in the STEM classroom setting. Hands-on experiences can offer memorable and relevant interactions that stabilize and solidify students' success. Providing an equitable and immersive experience is critical to student learning. However, visually impaired or blind students are limited with regard to select hands-on experiences. The purpose of this research is to design and evaluate 'audible' modules and titration modules to help demonstrate chemical reactions and acid-base chemistry for visually impaired students. Several experiments will be developed to significantly increase the understanding, satisfaction, and performance of visually impaired students in the chemistry classroom. This research is intended to improve the issue of equity with those visually impaired individuals with STEM interests. Visually impaired students at the Georgia Academy of the Blind will actively participate in classroom sessions. We will give qualitative surveys after the hands-on execution of the audible titrations and analyze data to evaluate the usefulness of the development and evaluation of audible titration modules. This project could benefit the visually impaired community by allowing educational experiments to be constructed and tested effectively.

Co-authors: Courtney Devera, Cassidy L. Fine, Rajeev Dabke, Kerri Shelton Taylor

Dr. Michael Dentzau & Dr. Kimberly Shaw, Teacher Education, Leadership, and Counseling & Earth and Space Science, Columbus State University
Understanding the value of a service learning experience for pre-service STEM teachers

Abstract for Dr. Michael Dentzau & Dr. Kimberly Shaw
Abstract: Possible-selves theory served as a theoretical lens to evaluate the experiences of pre-service STEM students as they reflected on the impact of an extended service commitment in a high-need school. Possible-selves theory refers to the perception an individual has with regard to what they might become or how they can envision themselves in the future. Through participation in the Robert Noyce Teacher Scholarship Program, funded by the National Science Foundation, pre-service science and mathematics teachers completed service opportunities embedded in high need schools and participated in seminars to reflect upon their experiences. Using a combination of Likert survey data and semi-structured interviews several themes emerged including, Service-Learning, Relationship Building, Gaining New Perspectives and Transformational Experiences. The insights generated from the participants may be valuable in developing authentic experiences for pre-service teachers to partially address the teacher shortage issue that is more acute in high-poverty/high-minority schools.

Session 4B - Room 214

Dr. Kristie Lipford Wyatt & LaCresha Cunningham, Whitney M. Young Jr. School of Social Work, Clark Atlanta University
Measuring Doula-Client Closeness: Patterns, Predictors, and Outcomes

Abstract for Dr. Kristie Lipford Wyatt & LaCresha Cunningham
Abstract: The African American extended family has traditionally been a major source of social and emotional support for families with text-sm children. Geographic proximity to parents, siblings, and other relatives is particularly advantageous during childbirth but also for infant care decisions, child nurturing, and the household responsibilities that follow the transition to motherhood and fatherhood. However, the increase in single parenting, reversal of Black migration patterns, changing cultural values, and greater upward mobility among African Americans has resulted in a widening of geographic distance and varied family dynamics. Consequently, this has caused a gap in the socio-emotional, mental, and practical

support for new mothers and in turn has resulted in an emerging need for perinatal and postpartum doulas. In the absence of traditional kinship networks, doulas often fulfill the role as extended family members.

The objective of this study was to investigate the perceived dimensions of the interpersonal relationships of women who have hired full-spectrum, birth, and postpartum doulas. We explore the process and factors that contribute to the relationship formation and social bonds between doulas and their clients. We also examine and compare levels of closeness and connectedness between a woman's doula, her extended female family members, and her female close friends. This is a mixed methods study that uses qualitative analysis of group storytelling and quantitative analysis of closeness and emotional intimacy measures.

Results from this study will be helpful in evaluating the doula care model and social bond attachments to understand how emotionally close relationships between doulas and their clients are formed and how they can be duplicated and maximized to promote positive maternal and birth outcomes.

Dr. Wen Shi, Accounting and Finance, Columbus State University

Abstract for Dr. Wen Shi
Abstract: Alabama is the fifth poorest state and about 16% (800,000) of Alabamians are below the poverty line. Due to the difficulties in accessing capital from traditional financial institutions such as banks and savings and loans, many consumers are forced to rely on predatory lending practices. Predatory lending promotes poverty by exploiting those caught in the poverty gap between low wages and the real cost of getting by through high-interest rates. Using cross-sectional data in 2011, 2015, 2016, and 2020, we employ the zero-truncated Poisson regression and negative binomial regression models to assess the impacts of traditional financial service providers, social economics, demographic factors, and payday regulation index on the intensity of the three most common predatory lending practices-pawnshops (PS), deferred presentiment Service (DPS), and text-sm loan providers (SLP) in Alabama. Results show that median household income and poverty level increase the numbers of PS, DPS, and SLP; the unemployment rate has positive effects on DPS concentration. Meanwhile, Banks serve as a substitute for PS and SLP, but with no effect on the concentration of DPS; credit unions serve as a complement for PS, but with no effect on DPS and SLP. Payday lender proxies have consistent and positive effects on all outcomes.

2:00 - 2:50 pm

Session 5A - Room 210

Dr. David Schwimmer, Earth and Space Sciences, Columbus State University
A Study of Cambrian Trilobite Paleontology Through the Lens of Plate Tectonics

Abstract for Dr. David Schwimmer
Abstract: Paleontological studies, usually focused on biological systems and their associated paleoenvironments, typically operate at very different scales than tectonic studies, which often focus on the location and mechanical behavior of lithospheric plates at a global scale. A paleontological study of 505-million-year-old trilobite taxonomy, however, demonstrates the importance of integrating science at all scales in order to understand events in the middle Cambrian. A common North American group of ptychoparioid trilobites had been revised generically in a 2013 publication, based on specimens collected in the Precordillera of Argentina. Following Schwimmer's prior work and subsequent collections from North Georgia, these Argentine fossils initially appeared to have incorrectly reassigned several North American genera. While this seemed illogical due to their respective locations, details of the tectonic history of the Argentine Precordillera indicates that at least the geographic aspect of the revision was potentially valid.

Integrating the magmatic and sedimentary history of Cambrian (541-495 Ma) rocks at both the surface and subsurface of the southeastern U.S., previous workers suggested a microcontinental crustal block approximately 800 X 800 km rifted away from ancestral North America (Laurentia), following the breakup of the Rodinian supercontinent and formation of the Iapetus Ocean. The microcontinental block, referred to as the Precordillera terrane, docked with the continent of Gondwana in present-day Argentina after drifting across a widening Iapetus Ocean during the Cambrian Period. But, it would have been proximal to the present day Gulf Coast during the timeframe in which the trilobites in this study were

present. Since trilobites were marine animals, their joint presence on both the Laurentian and the Precordilleran coasts would be possible. The original point of the study, based on details of the trilobite's morphology and paleoenvironments, still shows that the attempt at revision was incorrect. However, it also demonstrates the value of incorporating geology at a variety of scales in comprehensive studies of the past.

Co-author: Clinton I. Barineau

Dr. Ramneet Kaur, Biology, Columbus State University
The effect of natural products on the growth of triple-negative breast cancer stem cells(mammospheres).

Abstract for Dr. Ramneet Kaur
Abstract: Breast cancer is the leading cause of death in women worldwide. 1 in 8 women are diagnosed with breast cancer,15 to 20 % of which are diagnosed with TNBC, triple-negative breast cancer (cancer cells lack three proteins estrogen receptor, progesterone receptor, and Her-2 which are known to fuel the breast cancer cells). It is a very aggressive form of breast cancer with a high chance of relapse. It is difficult to treat TNBC as targeted therapy is unavailable for TNBC. Chemotherapy is often not the best option because it cannot distinguish between healthy fast fast-dividing cells and cancer cells. Patients receiving chemotherapy get very sick and die of the side effects of chemotherapy rather than cancer itself. We have some preliminary data showing the potential of natural products like ginger, garlic, blueberries, turmeric, grapefruit, and ashwagandha (herb) for the treatment of TNBC as natural products do not have side effects and are well tolerated. In this study, we are going to check the potential of natural products to kill TNBC stem cells. We are going to culture the cancer stem cells (mammospheres) and then check the effect of natural products on the growth of the TNBC stem cells.

Session 5B - Room 214

Dr. Hanna Lainas, Teacher Education, Leadership, and Counseling, Columbus State University
Effects of COVID-19 Pandemic on Counselor Education and Supervision of Graduate Students

Abstract for Dr. Hanna Lainas
Abstract: The purpose of this presentation is to present original survey-based research on the unique impact COVID-19 has had on gatekeeping and remediation in counselor education programs. Given the impact of the pandemic on the public in general (Kirzinger et al., 2020), and college students in particular (Son et al., 2020), it is expected that counseling students may have encountered stressors that have negatively impacted their ability to be competent students and professionals. Student impairment often warrants the implementation of remediation plans in counselor education (American Counseling Association, 2014; Bernard & Goodyear, 2014; CACREP, 2016). The process of remediation and gatekeeping posed challenges prior to the pandemic in general (Freeman et al., 2019; Miller et al., 2020), and to online learning specifically (Gilbert et al., 2019). However, the pandemic has posed unique challenges to training and remediation in counselor education. The presentation will review general concepts of gatekeeping and remediation, professional and academic issues typically experienced in counselor education, and unique challenges presented by the COVID-19 pandemic (i.e., disruptions to clinical work, virtual learning, stressors to students and faculty). The presenters will review the results of the research, which aims to survey counselor educators' perspective of challenges related to gatekeeping during and post-pandemic, and unique professional and academic concerns for students. Based on the results of the survey, the presenters will provide strategies for counselor educators to flexibly address challenges brought on by the pandemic, shift to remote learning and telehealth counseling. In addition, participants will learn how to better assess student professional and academic performance in a virtual setting while complying with ACA Code of Ethics and CACREP standards and create remediation guidelines that address the unique challenges of a pandemic.

Co-authors: Dr. Amy Berwick and Dr. Bailey MacLeod

Dr. Jennifer Lovelace, Teacher Education, Leadership, and Counseling, Columbus State University
Building Doctoral Retention Through Multi-Level Mentorship Opportunities

Abstract for Dr. Jennifer Lovelace

Abstract: Nationwide, doctoral students continue to drop from their doctoral programs at around 40-60%. For decades, researchers have discovered a multitude a factors that contribute to doctoral retention and attrition (i.e., previous experience, personal characteristics, advisor/advisee relationship, external pressures). Across both institution and discipline type, doctoral retention remains a serious issue for both higher education institutions and doctoral students alike. This study identifies one strategy for improving doctoral retention - mentoring. Mentoring has been proven to be beneficial in a variety of settings. Within the last two academic years, this doctoral program has implemented a multi-level mentoring program by which doctoral students are assigned a faculty mentor, peer mentor, alumni mentor, and when the time is right, a writing mentor for the dissertation phase. As a result, this doctoral program has seen a record number of graduates each term with extremely low attrition rates at all phases of the program. This presentation will outline the benefits of mentoring during each of the unique points within the doctoral program.

3:00 - 4:15 pm

Session 6 - Room 210

Dr. Michael Hull, Art, Columbus State University
Teaching the Benefits for Cross Platform Design

Abstract for Dr. Michael Hull

Abstract: Cross Platform Design (CPD) is a term I started using back in 2016. The process utilizes development and communication between standard open-source and proprietary software. This workflow allows for a more intuitive approach and will enable learners to design and develop quickly for multiple creative applications.

I currently teach Animation at CSU, and within this focus, there seems to be an evident weakness demonstrated by the learners. They seemed frustrated and disengaged when issues for sharing design and development projects were presented as confusing. Perhaps a methodology that utilizes the correct CPD to develop creative designs, interactive events, and the ability to share multiple file formats across current industry platforms.

Whatever the weakness, it's not just associated with my focus on animation. Other areas of study could benefit from this knowledge. STEM-related courses are the easy answer to which the process would help because the correct CPD would focus on communication and creative content development. CPD can open the door to both written-based and visual-based curricula.

The objective will be to introduce three new classes in Animation, Graphics, and possibly Narrative Art. However, these classes could benefit many programs and degree tracks within CSU.

The Three Possible Titles (the below bullet points will provide a broad view of the learning applications that could adopt the classes)

- I. Professional Digital Presentation - Objectives align with utilizing the web, mobile, and mixed social platforms to present the learner/artist/designer/professional/trades/sciences the knowledge, skills, and talents gained in their prospective degree maps. (Designed for third and fourth-year students)
- II. Applied 3D Lighting and Rendering - Objectives align with cross-platform design within current Content Managed Systems to present the learner/artist/designer/professional/trades/sciences the knowledge, skills, and talents gained in their prospective degree maps. (Designed for first and second-year students)
- III. Mixed Motion Design and Rigging - Objectives align with utilizing 2D/3D parenting and rigging systems to present the learner/artist/designer/professional/trades/sciences the knowledge, skills, and talents gained in their prospective degree maps. (Designed for third and fourth-year students)

Dr. Ana Pozzi Harris, Visual Arts, University of North Georgia
The UNG Bayeux Tapestry Replica: a tool for pedagogical innovation and student retention

Abstract for Dr. Ana Pozzi Harris

Abstract: In 2014, the University of North Georgia received a donation of a full-scale, hand-painted copy of the famous Bayeux Tapestry, the original 11th century embroidered artwork that visually narrates the events leading to and concluding in the Battle of Hastings (England, 1066). Measuring 224 ft. in length, the donation generated curiosity among faculty and students due to its remarkable similarity-in all but medium-to the invaluable medieval textile housed in Normandy, France. At the same time, the replica presented practical challenges. The most crucial problem was how and where to properly display it while also protecting it from decay, given its awkward format and fragile material. The second challenge was how to engage broad audiences-including faculty and students with diverse academic backgrounds, community members, and campus visitors-with a geographically and historically distant story about a world very different from our own. Since its arrival at UNG, the replica was displayed twice on campus and loaned to two other colleges, but beyond these excursions, it remained safely tucked in its ad-hoc built storage box. In fall 2023, a new building suitable for its display and an interest in calling attention to university-owned cultural assets for the benefit of student engagement led to the replica's resurgence and reevaluation as a teaching tool.

This presentation explores the strategies that were put in place, and which are planned for forthcoming exhibits of the replica. These aim at creating value for the university with this object, especially in the context of post-Covid decreased enrollment and preference for online pedagogies. In the September 2023 exhibit, a group of art history students will engage with the artwork by grappling with and reflecting upon the problems of installing and preserving it. Another student team has been trained as docents to text-lg visitors in understanding the story itself and its historical consequences. For future yearly exhibits, new community-building projects are envisioned, such as Bayeux Tapestry-inspired art and literary contests, a student-designed audio tour app, a children's coloring book, historically inspired medieval music or film composed by students, and printed canvas mini-replicas produced for sale. Our goal is to generate engagement with on-campus activities that will at once foster retention, build valuable transferable skills for students, and invigorate a connection with history. This innovative pedagogy where art exhibitions serve as a springboard for student engagement offers a viable model for teaching and learning.

Dr. Kelly Cate, Mackenzie Becker & Zoey Mitchell, Psychology & History, University of North Georgia
Performance of Gender: Three Key Eras of Historical Theater in Connection to Modern Queer Costume Art

Abstract for Dr. Kelly Cate, Mackenzie Becker & Zoey Mitchell
Abstract: In recent years, there has been an influx of proposed legislation throughout the United States that has aimed at censoring queer performance art due to the idea that it is inherently sexual or degenerate. Queer performance art has provided a reflection into queer culture and how queer culture fits into society, and this art has acted as a mode of passing down oral histories and traditions from one queer generation to the next; therefore, the preservation of queer performance art and its costumes is important for future generations to be able to review our modern history with full context. Through the creation of a pop-up exhibit titled "Performance of Gender: Historical Theater and Queer Costume Art," we propose the first step in this direction: This exhibition would prompt the reexamination of queer performance art so that it may be viewed in an academic light. In this way, we hope to shift the public perception of queer performance and costume from strictly entertainment to works of performance art that are worth preserving. We will accomplish this by creating an exhibit which showcases popular aesthetic themes in modern queer costume and connects them to periods in human history during which crossdressing was considered both entertainment and art. We will examine modern queer costume in connection with four key periods in performance art history: Ancient Greek theater, Kabuki theater of Edo Japan, Shakespearean theater of Elizabethan England, and the Vaudevillian Era of early American entertainment. By connecting modern queer costume to these historical eras, we will provide evidence that queer culture is a part of human history, and it is important that we preserve this part of our history for the public. This exhibit will be a stepping stone for a larger project that will provide a home for queer costume and queer performance analysis which will be accessible to the public. The goal of our larger project is to shift the public perspective of queer costume by evaluating and presenting queer art through an art historical lens as well as preserving and archiving queer costume and histories. Until we have found a permanent home for such a project, we intend to create pop-up exhibitions, such as this one, to showcase our research and present these artworks to the public.

5:00 - 7:00 pm

2023 Celebration of Faculty Research: Minds in Motion
Foyer and Blanchard Hall

5:00 - 5:30 PM **Minds in Motion Mixer** (reception with book & article displays)

5:30 - 6:00 PM **Snapshots of Innovation** - A four-slides-in-four-minutes challenge where faculty present research findings, creative activities, and innovative scholarly ideas in an engaging and entertaining format.

6:00 - 6:30 PM **SparkTalk: Minds in Motion Edition** - A roundtable discussion for colleagues to share insights on student-centered research, mentorship, funding strategies, best practices in research, and more!

2023 SparkTalk Guests:

- Lydia Ray, Professor, TSYS School of Computer Science
- Lisa Oberlander, Professor, Schwob School of Music
- David Kieran, Associate Professor & Distinguished Chair in Military History
- Molly Claassen, Associate Professor, Department of Theater and Dance
- Tugce Gul, Associate Professor of Science Education

6:30 – 7:00 PM **Minds in Motion Mixer Pt 2** (reception with book & article displays)