DSCD NEWSLETTER

Winter 2023 Issue

Dear colleagues,

Hope you had a wonderful winter break. We are pleased to share with you the new issue of ASME DSCD Newsletter. In this issue, you will find Chair's updates on recent developments and the future perspectives of our division. Then, the editorial team assembled three articles highlighting challenges and opportunities in three exciting domains that are of interest to our community: autonomous vehicles, humanoid robots, and human-robot collaboration. These are followed by reviews of the student activities and women's luncheon at MECC 2023, interview with one recent NSF CAREER Awardee, several honors and awards announcements, and upcoming conferences and openings.

Please enjoy your reading, and do not hesitate to contact us if you have messages to share with all.

Editor: Changliu Liu, Carnegie Mellon University
Senior Associate Editor: Shu-Xia Tang, Texas Tech University
Associate Editor: Minghui Zheng, University at Buffalo

Chair's Message

Jingang Yi

I am delighted to share updates on recent developments and the future perspectives of our division as the Chair of the Executive Committee (ExComm) for the ASME Dynamic Systems and Control Division (DSCD).

Following a comprehensive SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis last year, the ExComm successfully formulated the DSCD strategic plan in the summer of 2023. This initiative, kickstarted with a membership survey in early 2022, incorporated valuable insights from our members, ASME Technical & Engineering Communities (TEC) Council, and other stakeholders. The plan outlines five pivotal areas for advancing the Division: (1) membership growth and retention; (2) heightened impact and visibility of Division-sponsored journals and conferences; (3) enhanced productivity of technical committees; (4) commitment to diversity, equity, and inclusion (DEI); and (5) increased engagement with industry. For each area, we have identified key performance indicators, proposed specific actions, and established timelines. In the years to come, the ExComm will collaborate closely with DSCD members and ASME TEC to diligently monitor and report progress towards these strategic goals.

The year 2023 marked the 80th anniversary of ASME DSCD. To commemorate this significant milestone, the Division organized a celebratory event and a special session during the 2023 Modeling, Estimation, and Control Conference (MECC) held in October. It was inspiring to witness leaders and researchers from academia, industry, and government agencies come together to reflect on the Division's 80-year journey, acknowledge milestones, address challenges, and share insights on future directions in dynamic systems and control. The MECC also welcomed a new generation of students and young researchers, underscoring the Division's commitment to nurturing the next wave of talent. I am pleased to report a doubling of student membership over the past five years, surpassing 1,000 in 2023. The Division remains steadfast in its support of initiatives aimed at engaging students and young researchers, including various events and activities such as the DSCD Women Luncheon, Careers in Academic Panel Lunch, Rising Stars Invited Talks, and more. I encourage you to motivate your students and postdocs to actively participate in these events and propose new activities for the future.

In the realm of conferences, I invite your active participation in our sponsored events for 2024, including ACC in Toronto on July 8-12, AIM in Boston on July 15-18, and MECC in Chicago on October 28-30. Many conferences in our research communities now follow a joint concurrent submission model with high-impact journals. The 2024 AIM conference introduces the fifth edition of concurrent submissions with the IEEE/ASME Transactions on Mechatronics, a flagship journal co-sponsored by the Division. Additionally, the 2024 MECC initiates a concurrent submission option with the ASME Journal of Dynamic Systems, Measurement and Control, and ASME Letters in Dynamic Systems and Control, both sponsored by the Division.

Our Division now boasts an enhanced website, featuring updated information on Division governance, News and Events, Podcast, Honors and Awards, Technical Committees, and other related links, including our latest Newsletter. Your thoughts and suggestions are invaluable, and I encourage you to consider volunteering at any level to contribute to the Division's success.

Finally, I extend my gratitude to all our dedicated members who volunteer for Division activities and events, enabling us to continually grow and serve our community. As we embark on the new year, I wish each of you a joyful and healthy holiday season.

Editorial Board

The Dynamic Systems and Control Division Newsletter is published twice annually (Summer & Winter) to the Division's email list. Please submit your items for publication by e-mail to the editorial team or through this google form (https://forms.gle/dhVsP5DofPsjkJkr5):

Applications of Adversarial Generation Methods in Autonomous Driving Security

Yonggang Luo, Jucheng Yang, and Yining Meng

Abstract The safety of autonomous driving is a key aspect of the commercial deployment of autonomous driving technology. This paper starts from the perspectives of perception safety and decision-making safety, validating the emergency response capability of autonomous driving in perception robustness and natural adversarial scenarios, and comprehensively testing the safety technology of autonomous driving. For perception robustness testing, our work has established a model robustness evaluation platform. This platform can automatically generate adversarial examples and use these samples to test various vehicle perception algorithms. Through continuous evaluation, it can track changes in model performance and identify its weakness. At the same time, our work has developed a set of corresponding robustness reinforcement tools to resist adversarial sample attacks and improve its robustness. For decision-making level adversarial scenario testing, a natural adversarial simulation scenario generation framework has been established. It can generate natural adversarial driving scenarios in special situations including but not limited to highways, urban areas, and ramps, efficiently testing the adaptability of autonomous driving track control algorithms in adversarial scenarios and reducing the accident rate of algorithms in the real world.

Introduction

In today's rapidly evolving technology landscape, Artificial Intelligence (AI) has deeply integrated into every aspect of our lives, especially in the autonomous sector, where AI applications are changing the way we travel, enhancing the convenience and safety of driving. However, as AI technology is widely adopted, security issues are becoming increasingly prominent. We understand that true peace of mind comes only with safety. Among the many research directions in AI safety, adversarial generation methods have gradually become an important paradigm. Adversarial generation is not just a theoretical concept but a practical technical framework that plays a crucial role in the entire chain of artificial intelligence development processes. This method, by simulating attacker behaviors and challenging environments, enables AI systems to train, test, validate, and reinforce in more complex and realistic scenarios, thereby enhancing their overall safety and robustness. During the training phase of AI models, adversarial generation methods can produce a large variety of adversarial examples [1]. These samples simulate various attacks, such as subtle pixel changes in image recognition or semantic distortions in natural language processing. By introducing these adversarial samples during training, AI models learn to recognize and resist potential malicious attacks, thus enhancing their ability to cope with the complexity of the real world [2]. In the testing phase, adversarial generation methods also play a key role. By creating more complex and unforeseen test scenarios, they enable a more comprehensive examination of AI model's performance and safety. This not only helps identify weak aspects in specific situations but also provides guidance for subsequent model optimization. In the validation stage, adversarial generation continuously produces new adversarial examples, constantly challenge the limits of AI models, ensuring that models can resist various known and unknown attacks before release. In the reinforcement stage of AI systems, adversarial generation methods help systems continuously adapt to new threats by constantly updating and improving adversarial examples [3]. This dynamic reinforcement mechanism is key to maintaining the long-term security of AI systems, especially in the era of growing security threats, offering continuous protection. Overall, adversarial generation methods play a vital role not only in the development and deployment of AI systems but also throughout their entire lifecycle as a key to maintaining security. By applying these methods at every stage of training, testing, validation, and reinforcement, the safety of AI systems can be significantly enhanced, ensuring their stable operation in variable and hostile environments.

Perception Security

In the aspect of perception security, to enhance the robustness of the Changan Intelligent Drive perception system, an adversarial sample attack and defense platform has been built. The platform adopts a comprehensive closed-loop data flow and model evolution mechanism, focusing on improving the perception ability and robustness of AI systems, ensuring that in the face of diverse security threats, the intelligent drive perception system's response strategies are comprehensive and effective. The platform collects data from real-world application scenarios, reflecting various possible situations in the real world. Then, supplemented with advanced adversarial sample generation technology, it creates data samples for various simulated attack scenarios. These samples are designed to simulate various attack patterns that might occur in real environments, such as fine pixel-level changes in image recognition systems, thereby enhancing the predictive capabilities and complexity handling of the intelligent drive

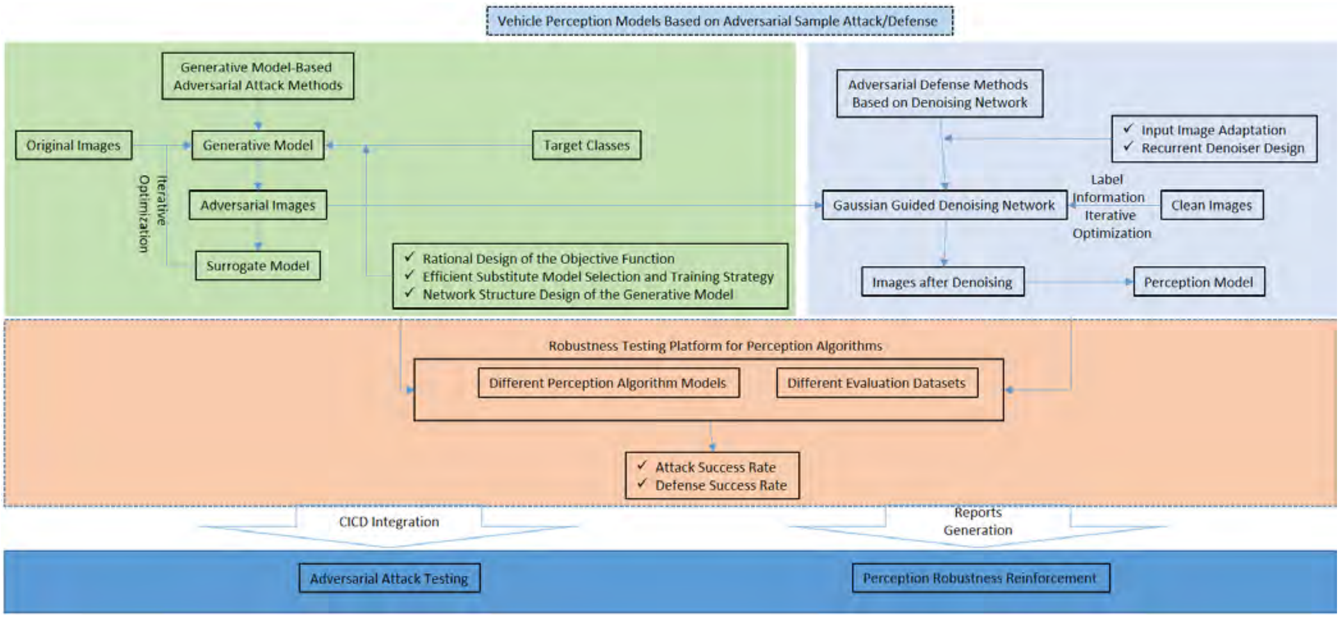

Figure 1: The framework of the adversarial sample attack and defense platform.

system [4]. During the adversarial training phase of the perception model, adversarial samples are used to systematically train and test the model. During this process, advanced attack and defense algorithms are employed, enabling the attack model to continually optimize its generated adversarial samples to deceive the defense model as much as possible. At the same time, the defense model enhances its ability to recognize and defend against adversarial attacks by learning from these samples. This continuous cycle of attack and defense promotes the robustness and adaptability of the perception model in various complex environments [5]. In the model evaluation phase, an independent test set and evaluation standards are used to comprehensively review the model's performance to ensure it can withstand various potential attacks before actual deployment. Additionally, the platform adopts a dynamic iterative mechanism, constantly adjusting adversarial sample generation strategies and model optimization methods based on real-time feedback. This closed-loop data flow and model evolution strategy not only improve the model's performance in the current environment but also ensure its capability to respond to future threats. Changan's adversarial sample attack and defense platform ensures the safety and reliability of the intelligent drive perception system in various complex environment through this comprehensive, systematic, and dynamic approach, effectively responding to current and future security threats.

Decision-Making Security

In terms of decision-making safety, due to the lack of real-world adversarial scenarios between actual vehicles, the emergency response capability of autonomous driving algorithms in adversarial situations directly determines the occurrence of traffic accidents. There is an urgent need to build various adversarial scenarios in simulated environments to validate autonomous vehicles and enhance the adaptability of track control algorithms. Using natural adversarial simulation driving scenario generation technology, at the functional scenario generation level, the IDM+MOBIL decision model is calibrated based on the natural driving data set [6]. The Bayesian optimization method is used to search for the parameter combination that maximizes the objective function in the fewest iterations [7], and a Flow-based generative model is employed to fit the distribution of real data using deep models [8]. Generative Adversarial Imitation Learning (GAIL) is used to model human driving behavior strategies [9]. The reward design is mainly composed of measures of danger and naturalness, with indicators such as Time-To-Collision (TTC) and collision occurrences expressing danger, and metrics like KL divergence and adherence to traffic rules measuring naturalness. The Adam optimizer is used for network parameter optimization [10]. Based on this technological approach, the automatic generation of natural adversarial scenarios in specific scenes within a simulation environment is achieved. The testing covers over more than 5000 basic scenarios such as highways, urban areas, intersections, and ramps, implementing comprehensive testing of the main vehicle's track control algorithm. According to Waymo's autonomous driving test report, which records one significant incident every 210,000 kilometers, the method proposed in this research improves the collision efficiency by an average of about 2 million times. This efficiently validates the emergency response capability of autonomous driving at

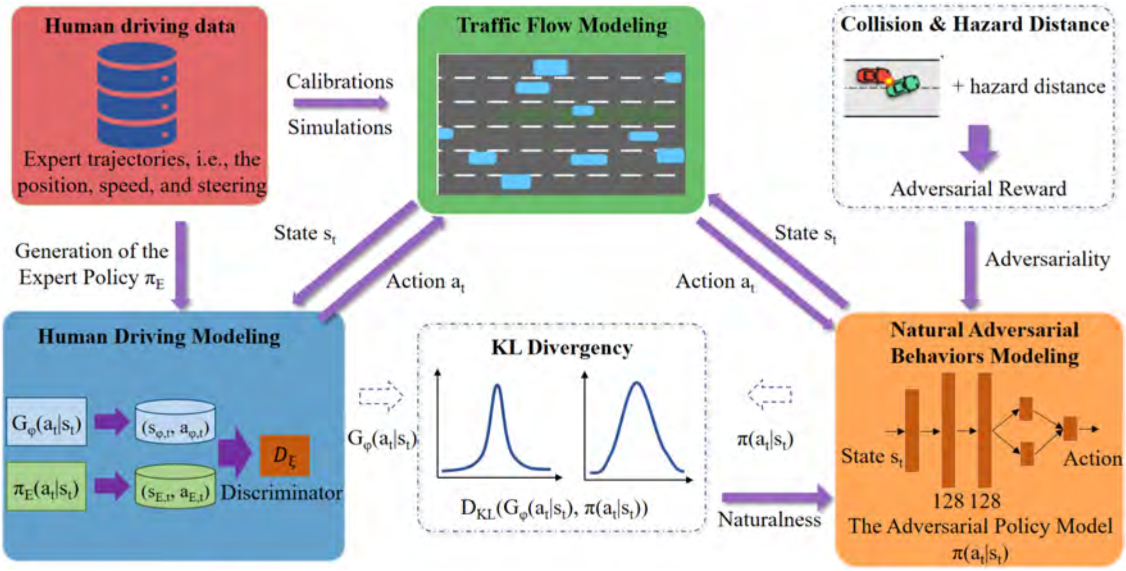

Figure 2: The framework of the adversarial scenario generation technology.

the decision-making level, ensuring that autonomous driving safety incidents are halted within the simulation environment.

Conclusions

Overall, the robustness and safety of autonomous driving systems have always been key challenges in the industry. The autonomous driving intelligent safety testing and verification system is an important mode of innovation, utilizing digital and intelligent means to achieve efficient, comprehensive, and precise testing of autonomous driving systems. This technological case provides an effective means of testing for autonomous driving, offering a safe and reliable testing scheme from the perspectives of perception and decision-making, and has been implemented in actual mass production, greatly enhancing the safety and reliability of autonomous driving systems. This provides other enterprises and researchers with opportunities to learn and study, while also allowing our technology and methods to undergo broader scrutiny and improvement. Looking forward, we will continue to commit to in-depth research and development in the field of AI safety, actively responding to technological challenges, and promoting the broader application of AI technology in ensuring safety. Our vision is to establish a comprehensive and multi-dimensional AI safety assurance system, covering multiple aspects such as data security, algorithm security, hardware security, and decision-making security. We will continue to optimize and perfect the existing autonomous driving intelligent safety testing and verification system, enhancing its testing and verification capabilities in various scenarios.

References

1. Madry A, Makelov A, Schmidt L, et al. Towards Deep Learning Models Resistant to Adversarial Attacks. International Conference on Learning Representations, 2018.

2. Wu B, Gu J, Li Z, et al. Towards efficient adversarial training on vision transformers. European Conference on Computer Vision. Cham: Springer Nature Switzerland, 2022: 307-325.

3. Xie S, Li Z, Wang Z, et al. On the Adversarial Robustness of Camera-based 3D Object Detection. arXiv:2301.10766, 2023.

4. Yang X, Dong Y, Pang T, et al. Boosting transferability of targeted adversarial examples via hierarchical generative networks. European Conference on Computer Vision. Cham: Springer Nature Switzerland, 2022: 725-742.

5. Liao F, Liang M, Dong Y, et al. Defense against adversarial attacks using high-level representation guided denoiser. Conference on Computer Vision and Pattern Recognition, 2018.

6. Smith, A., & Li, B. (2020). Application of Reinforcement Learning in Autonomous Driving. Journal of Artificial Intelligence Research, 67, 45-66.

7. Johnson, T., & Zhang, L. (2019). Deep Reinforcement Learning for Autonomous Driving: A Review. Journal of Robotics and Computer-Integrated Manufacturing, 57, 321-334.

8. Lee, J., & Park, J. (2021). Real-Time Control of Autonomous Vehicles Using Deep Q-Learning. Robotics and Autonomous Systems, 137, 103968.

9. Wang, Y., Xiao, B., & Wu, Z. (2022). Hierarchical Reinforcement Learning for Autonomous Driving in Urban Environment. IEEE Robotics and Automation Letters, 7(2), 990-997.

10. Kiran, B. Ravi, et al. (2021). Deep reinforcement learning for autonomous driving: A survey. IEEE Transactions on Intelligent Transportation Systems, 23.6: 4909-4926.

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Towards Building Humanoid General Intelligent Robots

Jianyu Chen

Introduction

The development of human-like intelligent robots has been a longstanding aspiration of humanity. These machines are envisioned as powerful tools to assist with various tasks and serve as companions. The world is built by human, therefore an intelligent humanoid robot can go all places a human can go, and can do almost all activities a human can do. Due to these great properties, humanoid robots have unlimited application potentials and might define new business ecology.

However, the humanoid robot stands as the most intricate and multifaceted robot in both hardware and software, integrating a wide range of functions from various types of robots such as legged locomotion, hand manipulation, and visual navigation. This article will briefly introduce these challenges, and present the current progress achieved by Robot Era,[1] our recent founded startup company, as well as the Intelligent Systems and Robotics Lab (ISRLab) at Tsinghua University.[2]

[1] https://www.robotera.com/
[2] https://group.iiis.tsinghua.edu.cn/ isrlab/

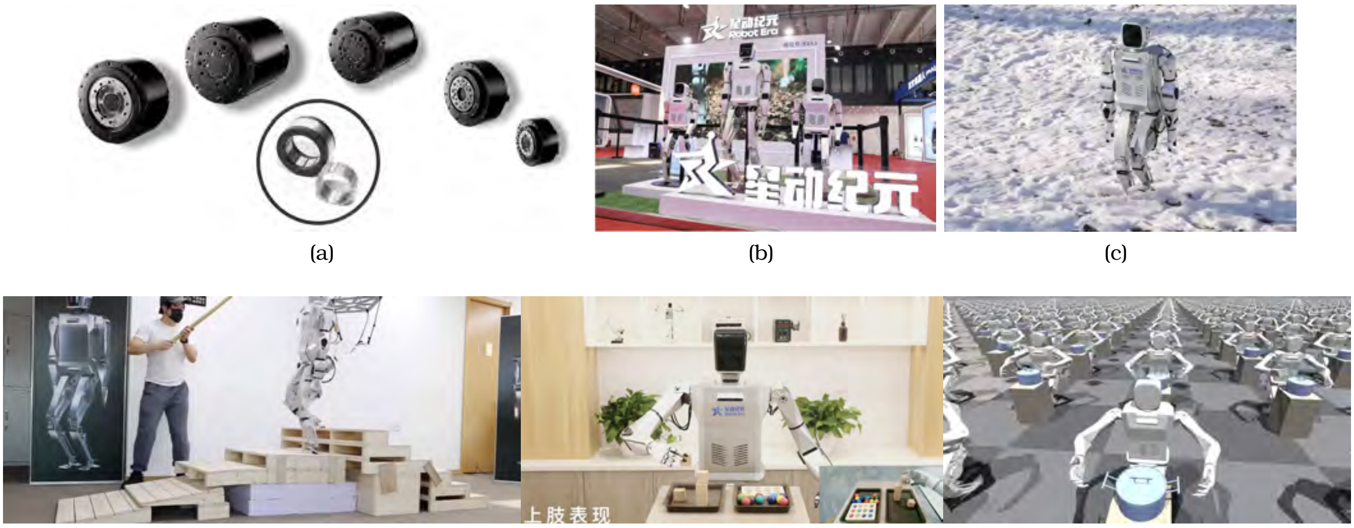
Hardware Development

A high-performance and reliable hardware is crucial for building a high-end humanoid robot. To construct a robot that exhibits human-like dynamic behavior, we have developed a novel generation of humanoid robot hardware platform from the ground up. In lieu of conventional high stiffness, position-controlled actuators, we have developed high torque density and compliance actuators.

The actuation system is the fundamental element in constructing a successful humanoid robot platform. Traditional humanoid robots utilize high gear reduction with force torque sensor actuators [1]. However, this approach renders the robot fragile and highly susceptible to impact. Drawing inspiration from biological muscle, the series elastic actuator (SEA) introduces an elastic element between the gearbox and the load to mitigate the impact. However, this approach presents challenges in handling diverse spring stiffness.

Proprioceptive actuation, which employs motor current to estimate the torque output of the actuator, offers advantages such as low gear ratio and improved transmission transparency [2]. This approach has been widely adopted in commercialized quadrupedal robots. However, its successful implementation in humanoid robots poses significant challenges due to their higher weight and degree of freedom (DOF) compared to quadrupedal robots. To address these challenges, we have developed all actuators, including electric motors, gear boxes, and drivers, as shown in Figure 3a.

The mechanical structure is a pivotal component of a humanoid robot, as it serves to connect all actuators to the body links. A well-designed humanoid robot should possess a comparable degree-of-freedom (DOF) to that of a human being. The design of the lower limbs is particularly crucial for humanoid locomotion. As illustrated in Figure 3b, our current humanoid robot hardware comprises two types. Unlike traditional designs where actuators are displaced at the joint position, all three types extensively employ transmission tools to move the actuators away from the joints,



(a) (b) (c)

(d) (e) (f)

Figure 3: (a) Actuators for our humanoid robots. (b) Hardware structure of our humanoid robots. (c) Navigating in snow with end-to-end reinforcement learning. (d) Up and down stairs with end-to-end reinforcement learning. (e) Humanoid robot bi-dexterous manipulation. (f) Humanoid robot bi-dexterous manipulation in parallel simulation.

thereby reducing leg inertia. To ensure strength, we utilize four bar linkages.

Locomotion Control

Bipedal locomotion is a critical skill for general humanoid robots, and it has been a long-standing challenge dating back to the 1970s. Previously, most humanoid robots have employed simplified models with static balance control, such as the integration of the Zero Moment Point (ZMP) and the Linear Inverted Pendulum Model (LIPM). While this approach is relatively straightforward to implement, it is limited to periodic walking due to its inability to account for dynamics information. As a result, the gait appears relatively stationary and lacks stability, despite being kinematically accurate.

In comparison, dynamic robots such as Boston Dynamics Atlas employ numerical optimization techniques, specifically Model Predictive Control (MPC) with Whole Body Control (WBC), to achieve highly dynamic motions [3]. However, the use of hydraulic actuation in Boston Dynamics Atlas allows for the provision of extremely high force density. On the other hand, our proprioceptive actuation is capable of delivering high torque density as well, although it may not yet be on par with that of Boston Dynamics.

Although these model-based locomotion methods have demonstrated effectiveness in flat terrains, they encounter limitations when navigating unstructured and rough terrains. Addressing this challenge is a key focus of our work to bridge the simulation-to-reality gap in locomotion for reactive robots. Presently, we have successfully applied end-to-end Reinforcement Learning (RL) to develop robust biped legged locomotion skills for our humanoid robot [4], which can navigate in an outdoor snowy environment, ascend and descend a slope without slipping or tripping over snow, as shown in Figure 3c. The robot can also climb up and down a set of makeshift, rickety stairs, as shown in Figure 3d.

Manipulation Control

A proficient humanoid robot should possess not only effective legged locomotion skills, but also dexterous hand manipulation abilities. Due to the high DoF of arms and hands as well as the complex contact with the objects, we believe learning-based methods are more suitable for bi-dexterous hand manipulation than model-based control. When using imitation learning, an efficient data collection system is needed. We have developed tele-operation systems for fine-grained humanoid bi-manual control (Figure 3e). When using reinforcement learning, a fast simulator is needed for efficiently sample rollouts in simulation for training. We use parallel simulation for reinforcement learning of our robot in Figure 3f.

A crucial challenge for humanoid robots is the integration of manipulation and locomotion. Previous work has shown that using a single neural network as the policy in quadruped robots can result in stability issues and a highly task-specific behavior. To address this issue, we proposed a Decentralized Motor Skill (DEMOS) learning algorithm [5]. This algorithm automates the discovery of motor groups that can be decoupled from each other while preserving essential connections. Subsequently, a decentralized motor control policy is learned, enabling the robot to

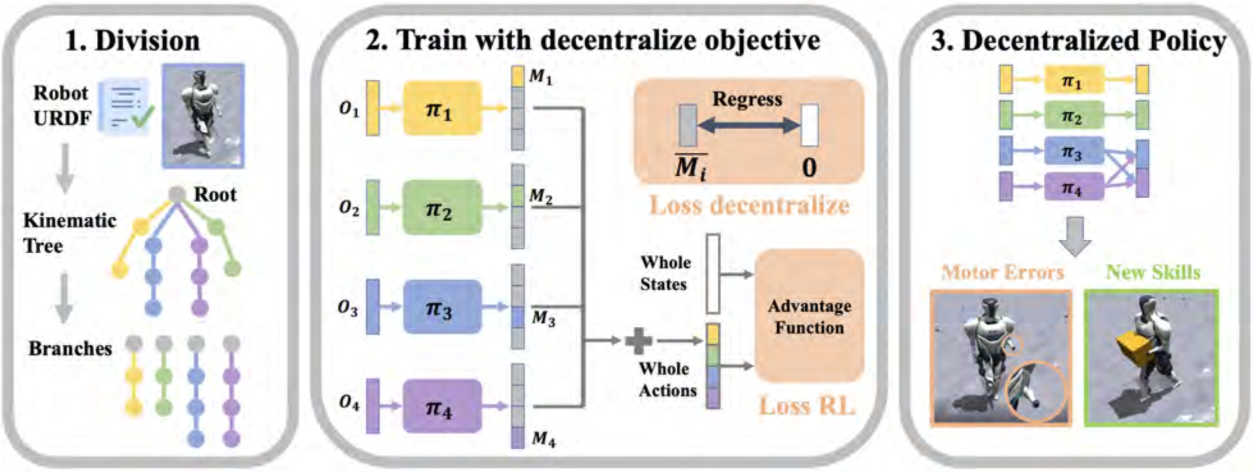


Figure 4: Decentralized Motor Skill (DEMOS) learning algorithm [5].

perform manipulation tasks while simultaneously exhibiting effective locomotion skills, as illustrated in Figure 4.

Foundation Models for Decision Making

Large language models (LLMs) encode a vast amount of semantic knowledge and possess remarkable understanding and reasoning capabilities. Previous work has explored how to ground LLMs in robotic decision making to generate feasible and executable textual plans. However, low-level execution in the physical world may deviate from the high-level textual plan due to environmental perturbations or imperfect controller design. To tackle the above challenges, we propose DoReMi, a novel language model grounding framework that enables immediate Detection and Recovery from Misalignments between plan and execution[6]. Specifically, we leverage LLMs to play a dual role, aiding not only in high-level planning but also generating constraints that can indicate misalignment during execution. Then vision language models (VLMs) are utilized to detect constraint violations continuously. Our pipeline can monitor the low-level execution and enable timely recovery if certain plan-execution misalignment occurs, as shown in Figure 5.

Conclusions

This article firstly introduced the motivation and importance of building general-purpose intelligent humanoid robots. It then introduced the techniques towards building intelligent humanoid robots, in respect of hardware, locomotion control, manipulation control, and decision making. Our recent progress are shown in the article for each parts, including proprioceptive actuation design, MPC and RL based robust locomotion controller, bi-dexterous manipulation skill learning, coordinated locomotion and manipulation learning, as well as LLM and VLM models for decision making. Although several achievements are reached, there are still a long way to go in the future towards our ultimate goal, e.g, building human-level athletic hardware, human-level dexterous locomotion and manipulation control, and generalizable intelligence. Neverthless, we believe that a that a new era of robots will finally emerge, hopefully in the future not far from now.

References

[1] Y. Sakagami, R. Watanabe, C. Aoyama, S. Matsunaga, N. Higaki, and K. Fujimura, "The intelligent asimo: System overview and integration," in *IEEE/RSJ international conference on intelligent robots and systems*, vol. 3, pp. 2478–2483, IEEE, 2002.

[2] S. Seok, A. Wang, M. Y. Chuah, D. Otten, J. Lang, and S. Kim, "Design principles for highly efficient quadrupeds and implementation on the mit cheetah robot," in *2013 IEEE International Conference on Robotics and Automation*, pp. 3307–3312, IEEE, 2013.

[3] S. Kuindersma, R. Deits, M. Fallon, A. Valenzuela, H. Dai, F. Permenter, T. Koolen, P. Marion, and R. Tedrake, "Optimization-based locomotion planning, estimation, and control design for the atlas humanoid robot," *Autonomous robots*, vol. 40, pp. 429–455, 2016.

[4] N. Tao, "Robot era puts humanoid biped to world's 'first outdoor snow test' on ai capacity,".

[5] Y. Guo, Z. Jiang, Y.-J. Wang, J. Gao, and J. Chen, "Decentralized motor skill learning for complex robotic systems," *IEEE Robotics and Automation Letters*, 2023.

[6] Y. Guo, Y.-J. Wang, L. Zha, Z. Jiang, and J. Chen, "Doremi: Grounding language model by detecting and recovering from plan-execution misalignment," *arXiv preprint arXiv:2307.00329*, 2023.

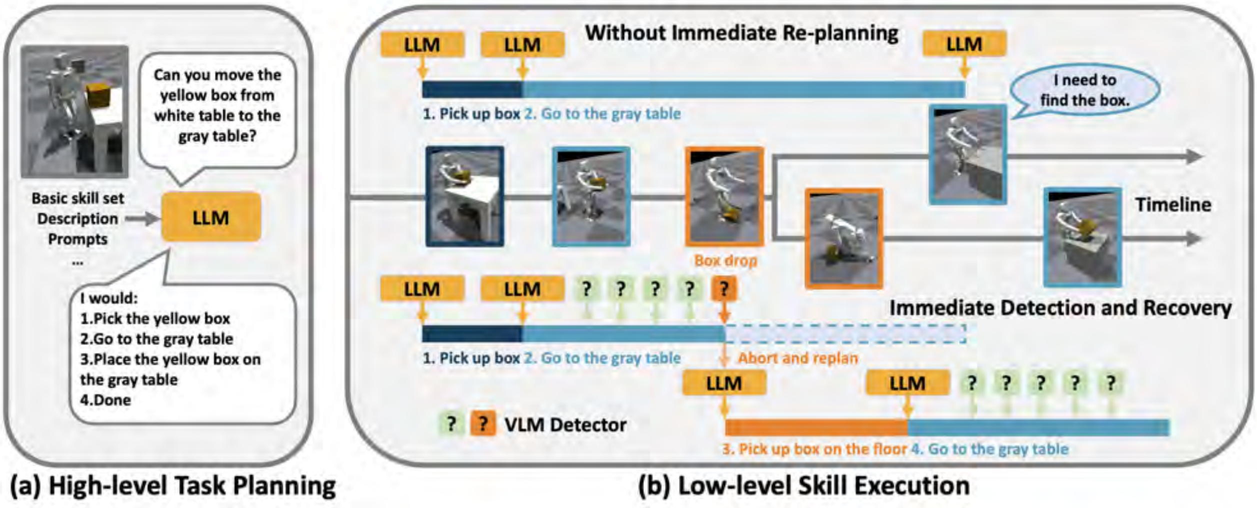


Figure 5: Grounding language models with plan-execution misalignment [6].

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A Brief Discussion on Opportunities and Challenges in Disassembly with Human-Robot Collaboration*

Meng-Lun Lee, Xiao Liang, Boyi Hu, Gulcan Onel, Sara Behdad, and Minghui Zheng
* This discussion is based on our recent literature review paper on human-robot collaborative disassembly (https://doi.org/10.1115/1.4063992).

Overview

Product disassembly plays a crucial role in the recycling, remanufacturing, and reuse of end-of-use products. However, the current manual disassembly is not efficient due to the complexity, uncertainty, and variation of end-of-use products. While fully automating disassembly is not economically viable given the intricate nature of the task, there is potential in using human-robot collaboration (HRC) to enhance disassembly operations. HRC combines the flexibility and problem-solving capabilities of humans with the precise repetition and handling of unsafe tasks by robots. Nevertheless, many challenges persist in technology, human workers, and remanufacturing work, that require comprehensive multidisciplinary research to bridge critical gaps. These challenges have motivated us to provide a brief discussion on the opportunities and challenges associated with introducing HRC to disassembly.

Motivation and Opportunities

Environmental regulations, growing consumer demand for eco-friendly products, resource scarcity, and the potential profitability of salvaging operations have sparked a heightened interest in end-of-use product recovery. This has prompted manufacturers to incorporate remanufacturing into their business models. Notably, even beyond the environmental economic value of what they once considered as trash. Industrial examples have demonstrated that remanufactured parts can be priced up to 50% lower than new parts, showcasing the potential cost savings. Implementing strategies such as optimizing the recycling process, embracing remanufacturing, improving disassembly techniques, and expanding repair and maintenance services all have positive impacts on businesses. For manufacturers, remanufacturing their own products allows them to explore innovative business models, such as product-service systems and subscription-based models, while gaining greater control over the market by creating their own product ecosystems. From a socioeconomic perspective, semi-manual remanufacturing processes contribute to increased employment rates by generating new tasks and driving the need for expanded repair and remanufacturing efforts. The remanufacturing industry has shifted its focus from cost minimization to value creation for the broader social and economic systems. This paradigm shift necessitates interdisciplinary research and coordination across multiple fields, including economics, policy, occupational health, and engineering, among others.

Despite the inspiring vision and successful examples of remanufacturing efforts, there exist significant barriers to designing an effective remanufacturing system. Challenges such as the labor-intensive nature of disassembly, high labor costs, small lot sizes, uncertainty regarding the quality of incoming cores, core unavailability, and the lack of automation hinder efficient and profitable remanufacturing. Remanufacturers often face difficulties in maintaining control over the supply chain, as they passively accept used products with uncertain quality, quantity, and conditions, which further complicates the remanufacturing and disassembly processes. While manufacturers have made great strides in reducing manufacturing cycle times through the extensive use of robotic technologies in assembly processes, the reverse logistic aspect of the process still poses challenges. Disassembly remains predominantly labor-intensive, requiring direct contact with potentially harmful elements that can affect human health. Current manufacturing design guidelines, focused on optimizing assembly efficiency, often overlook disassembly considerations, resulting in suboptimal practices. The automation of disassembly remains an underdeveloped field.

HRC presents a promising solution for the labor-intensive disassembly process. By leveraging the unique strengths and capacities of both humans and robots, the goal is to compensate for each other's weaknesses. Integrated efforts are required to improve the efficiency, safety, and sustainability of the disassembly line within the remanufacturing work domain. Collaborative tasks such as disassembly, repair, and replacement can be carried out by robot manipulators and human workers, fostering a collaborative environment in remanufacturing factories (workplace).

Although there has been an increasing adoption of HRC in disassembly, many challenges in this domain have not been thoroughly identified, discussed, or studied. We aim to identify the gaps that currently exist among technology, workers, and the work environment. Addressing these gaps is crucial to fully harnessing the potential of HRC in remanufacturing and ensuring its successful integration into industry practices.

Key Challenges

The incorporation of HRC within remanufacturing facilities offers substantial sustainability benefits and enhances the quality of human work experiences. However, it also introduces a set of interconnected challenges that affect technology, workers, and the overall work processes. While HRC has been explored in the context of manufacturing, its specific implications in the realm of disassembly remain relatively underexplored. Particularly, in the case of end-of-use products characterized by traits like low-volume production, high diversity, and variable quality, the integration of collaborative disassembly presents challenges for both human operators tasked with efficient disassembly and robots striving for complete automation. This is particularly relevant for SMEs that may possess limited resources for adaptation. This section delves into the multifaceted challenges associated with the introduction of HRC into the disassembly process, drawing from our extensive review of recent literature. We have considered not only papers directly related to HRC in disassembly but also research in related sub-domains.

Disassembly cannot be simply considered as the reverse of assembly: current manufacturing design guidelines, such as the minimization of part counts and the use of self-fastening components, tend to prioritize assembly efficiency at the expense of disassembly. Moreover, disassembly often involves a diverse array of end-of-use products, each with uncertain quantities, varying quality, and differing conditions. Consequently, the implementation of HRC in disassembly processes must meet three critical criteria: (1) efficiency, (2) affordability, and (3) adaptability to the wide range of end-of-use products characterized by substantial uncertainties. The necessity for adaptability, from a technological standpoint, places a premium on precise human motion prediction—a formidable task given its complexity and nonlinearity inherent in disassembly activities. This complexity is further compounded by the unpredictability introduced by environmental factors and interactions with other agents. Moreover, the absence of widely-accepted real-world datasets specific to disassembly poses a significant hurdle in training and validating prediction models. Efficiency and cost-efficiency pose another technological challenge in the implementation of HRC for disassembly, particularly when dealing with end-of-use products with limited resale value. Existing safety mechanisms, such as halting or slowing down robots when they come into proximity with human workers, can substantially impede overall efficiency in HRC scenarios, making the application of HRC in disassembly significantly more challenging. Thus, the paramount objective becomes the maximization of operational efficiency while minimizing cost, all the while ensuring the utmost safety for human workers. This balance is essential to facilitate the widespread adoption of HRC in disassembly processes. Conquering these multifaceted challenges and devising effective solutions remains an ongoing pursuit within this research domain.

When considering the perspective of workers in HRC scenarios for disassembly, it becomes evident that ensuring physical safety alone is insufficient. This is because the disassembly environments for end-of-use products can often be characterized by poor structure, disorder, dirtiness, and potential hazards. Unlike assembly sites, which are typically clean, well-organized, and equipped with advanced technology, workers in disassembly settings face a higher vulnerability to excessive mental stress and psychological workload. Therefore, the design of HRC for disassembly must prioritize the mental and psychological well-being of workers to foster comfortable interaction and collaboration between humans and technology. Addressing these aspects introduces new challenges, particularly in the development of comprehensive and dependable measurement methods to evaluate the mental and psychological health of workers engaged in HRC disassembly. Moreover, from an occupational safety standpoint, existing standards such as ISO standard 10218 generally do not explicitly account for personnel safety, let alone in the context of disassembly environments. These complexities in safety considerations extend beyond those typically encountered in manufacturing sites. A noteworthy gap emerges in the realm of regulations and policies related to the mental and psychological health of human workers and occupational safety within the context of disassembly. These gaps must be effectively addressed before the widespread implementation of HRC in disassembly and re-manufacturing can realized. It is important to note that this particular aspect remains an underexplored area in existing literature, highlighting the need for further research and policy development in this crucial domain.

Regarding work, while substantial efforts have been made to model the effects of artificial intelligence on labor markets and the broader economy, recent studies have yet to comprehensively account for the distinct characteristics of the emerging remanufacturing sector, particularly within the context of advanced HRC systems. Nevertheless, the potential for significantly enhanced efficiency and productivity through HRC in disassembly is undeniable. By entrusting robots with repetitive or hazardous tasks, human labor can pivot towards more strategic roles, thereby elevating the overall quality of work. The evolution of disassembly with HRC has the power to catalyze a transformation in the workforce, ushering in new job opportunities and roles. The future of disassembly labor within an HRC framework envisions a collaborative environment where humans and robots synergize to leverage their respective capabilities. However, realizing these benefits hinges on meticulous planning and strategic investment. It is crucial to recognize that there are tangible costs associated with the adoption of this technology. Expenses linked to technology acquisition, training, safety measures, and change management are very much real. For example, existing HRC-enabled workstations designed for specific products may not be economically adaptable to the disassembly of end-of-use products, given their unique characteristics of low-volume and high diversity. SMEs, which constitute a significant sector in the disassembly and recycling of end-of-use products, often grapple with limited capital resources required for the initial setup costs of collaborative robots. Thus, the challenge lies in finding ways to reduce the cost of HRC-enabled disassembly, encompassing technology acquisition, training, safety measures, and more, while simultaneously maximizing the profitability of recycling end-of-use products. Nonetheless, when evaluating these investments in the broader context of potential benefits, they can be deemed as indispensable steps. Such investments not only hold the promise of economic prosperity but also aspire to shape a future where businesses operate at heightened productivity levels, jobs are safer and more fulfilling, and the manufacturing sector embraces sustainability as a guiding principle.

Beyond the interconnected challenges discussed earlier, the integration and implementation of HRC in disassembly introduce an even greater level of complexity. Several critical loops in this ecosystem remain insufficiently explored and unresolved: (1) Product Design Guidelines: Existing product design guidelines have yet to encompass considerations related to HRC-enabled disassembly. The current design principles tend to overlook the intricacies of disassembly with human-robot collaboration. (2) Occupational Safety Standards: Present occupational safety standards predominantly emphasize short-term physical safety, particularly the prevention of collisions and accidents. The broader aspects of safety, especially concerning mental and psychological well-being, remain less emphasized. (3) Economic Literature: Conventional economic literature has not sufficiently addressed the modeling of HRC production systems and their implications for labor markets. Often, these models assume a scenario where robots entirely replace human labor rather than focusing on how robots can complement human work. Additionally, these models may not adequately account for the unique dynamics of the remanufacturing sector, where data on economic activities are limited. The absence of sector-specific economic data in the remanufacturing domain further complicates the development of accurate models and analyses.

In summary, the complexities of incorporating HRC into disassembly processes are multifaceted, encompassing technology, workers, work processes, and their seamless integration. Although the potential advantages are significant, it is imperative to engage in meticulous planning, substantial investment, and effective coordination across various domains to successfully navigate these challenges. Such efforts are instrumental in shaping a future where HRC in disassembly translates into heightened productivity, increased job satisfaction, and a more sustainable approach to industrial processes.

Meng-Lun Lee received the Ph.D. degree in mechanical engineering from the Department of Mechanical and Aerospace Engineering, University at Buffalo. He is currently an Assistant Professor at Oregon Institute of Technology. His research interests include robotics, deep learning, sequence and motion planning, and human-robot collaboration.

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Sara Behdad received the B.S. and M.S. degrees in Industrial Engineering from Tehran Polytechnic and her Ph.D. degree in Industrial and Enterprise Systems Engineering in 2013 from the University of Illinois at Urbana-Champaign, IL, USA. She is currently an Associate Professor at the Engineering School of Sustainable Infrastructure & Environment at the University of Florida, FL, USA. She has served as an associate editor for the ASME Journal of Mechanical Design and Journal of Manufacturing Science and Engineering. Her research interests include sustainable design, remanufacturing, and product lifecycle engineering.

Minghui Zheng received B.S. degree in engineering mechanics in 2008 and M.S. degree in control science and engineering in 2011, both from Beihang University, China, and the Ph.D. degree in mechanical engineering from the University of California, Berkeley, CA, USA, in 2017. She joined the University at Buffalo, Buffalo, NY, USA, in 2017, where she is currently an Associate Professor of mechanical and aerospace engineering. Her research interests include motion planning, control, and human-robot collaboration for manufacturing and remanufacturing. She was the recipient of the NSF CAREER Award in 2021.

Note:

This discussion is based on our recent literature review paper on human-robot collaborative disassembly:

Lee, M., Liang, X., Hu, B., Onel, G., Behdad, S., and Zheng, M. (December 4, 2023). "A Review of Prospects and Opportunities in Disassembly With Human–Robot Collaboration." ASME. J. Manuf. Sci. Eng. February 2024; 146(2): 020902. https://doi.org/10.1115/1.4063992.

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MECC 2023 Student Activities

Satadru Dey (Pennsylvania State University) and Hossein Rastgoftar (University of Arizona)

Various activities were organized and hosted for students and young members of the community during the MECC 2023. The best student paper competition received **26** nominations from the community, and a panel of judges selected five finalists from them. During the conference, these five finalists were invited to present their respective papers in front of a panel of judges who ultimately selected the winner. Apart from the best student paper competition, DSCD Rising Stars invited sessions were organized where postdocs and senior Ph.D. students nearing graduation showcased their research accomplishments. A total of four sessions were organized focusing on energy storage, robotics, learning and estimation, and control design and applications – where the rising stars of the community presented their research. A networking session among the rising stars was also hosted. A special session titled “Careers After PhD: Possibilities and DEI Perspective” was hosted where panelists from academia, industry, and government lab interacted with the students and discussed various topics related to education-to-workforce transition and diversity, equity, and inclusion. The conference also provided partial travel support to **82** students through the generous funding from AACC and ASME-DSCD.

ASME DSCD Women’s Luncheon at MECC 2023

Minghui Zheng (University at Buffalo) and May-Win Thein (University of New Hampshire)

A women’s luncheon was organized and hosted during the Modeling, Estimation and Control Conference (MECC) at South Tahoe Events Centre, Lake Tahoe, Nevada, on October 3rd, 2023. It was sponsored by the ASME Dynamic Systems and Control Division (DSCD). It aims to bring new female members into DSCD, facilitate mentoring development, and promote the retention, recruitment, and growth of female DSCD members. We are very honored to have four amazing panelists, Pro. Ella Atkins from Virginia Tech, Prof. Simona Onori from Stanford University, Prof. Juan Ren from Iowa State University, and Prof. Anna Stefanopoulou from the University of Michigan, to share their insights and suggestions related to women’s careers and leadership roles in academia. Approximately 40 participants participated in the women’s luncheon. It was a great opportunity to network, share experiences and stories in research and careers, foster collaboration, and build connections with the growing group of female researchers in dynamics and control.

ASME DSCD Women Luncheon

Interview with Recent NSF CAREER Awardees

Mamadou Diagne

Bio: Mamadou Diagne holds the position of Assistant Professor with the Department of Mechanical and Aerospace Engineering at UC San Diego. In 2013, he completed his Ph.D. at the Laboratoire d'Automatique et du Génie des Procédés of Université Claude Bernard Lyon I in France. From 2013 to 2016, he was a postdoctoral researcher at UC San Diego and University of Michigan. Between 2017 and 2022, he was Assistant Professor with the Department of Mechanical Aerospace and Nuclear Engineering at Rensselaer Polytechnic Institute. His research focuses on the control of partial differential equations (PDEs) as well as systems that are described by PDEs coupled with nonlinear ordinary differential equations (ODEs) known as PDE-ODE cascade systems. He has coauthored significant contributions on delay systems control, adaptive estimation and control, and event-based control. His expertise extends to the control fluid and flow systems, with applications to water systems, extrusion processes, traffic systems, supply chains and production systems. He received the NSF CAREER Award in 2020.

Q: Congratulations on your recently awarded CAREER project! Can you please introduce it to our readers?

A: Thank you very much. The focus of my NSF CAREER project is on addressing the challenges associated with managing water resources in human-engineered water infrastructures. Spatiotemporal dynamics governing the evolution of both water and sediment layers in a river– the 1D Saint-Venant Exner model augmented with suspended sediment particles dynamics– powered by gate actuation mechanisms is explored to achieve stability of sediment entrainment and deposition rates while satisfying water demand. Often, the extraction of water for various purposes, whether through gates or dams' manipulation, can significantly impact the stability and health of ecosystems in the surrounding environment of water courses such as rivers. The alteration of the flow regimes does not only change the natural flow in water ways but causes substantial losses of natural habitats, degrades water quality and temperature while inducing huge disruptions in diverse ecological processes that sustain biodiversity.

Q: What are your suggestions how to prepare a successful CAREER proposal?

A: The primary objective of a CAREER grant is to provide support to young researchers, enabling them to cultivate a comprehensive understanding and vision within their respective field. The word vision is associated to a long-term goal over a span of at least ten years. To reflect thoughtfully on one's professional trajectory in the coming decades is pivotal to the development of a vision supported by a CAREER grant. The vision establishes a nexus between exemplary research concepts and inventive yet practical solutions. The comprehensive impact of the proposed research and educational strategy is crucial for the success of not only the CAREER proposal but also for any proposal. Significance within the community, active engagement with society, mentorship, and the seamless integration of training and development with research and education are fundamental components.

Q: What are the most exciting research challenges and opportunities in your research fields?

A: There are ample opportunities to make noteworthy contributions in the expansive research field of optimization and control systems. Recent advances, especially in physics-informed data- driven approaches, provide a promising path that prompts many currently debated questions. Advancements in connecting fundamental modeling, control design, and information science are creating plentiful opportunities for researchers interested in the "conventional" control systems theory. From an application or practical transition standpoint, control problems arising from critical questions related to climate change, water, and energy systems hold critical relevance.

Q: Can you please describe your career up to date?

A: Presently, I serve as an Assistant Professor in the Department of Mechanical and Aerospace Engineering at the University of California, San Diego. Within my research group, I collaborate with a diverse mix of PhD and undergraduate students. Over time, the size of my research group has consistently expanded, and I've cultivated collaborations with numerous international researchers, thereby broadening the reach and impact of my work. My research exploration spans various subfields in control systems, encompassing topics such as the control of infinite- dimensional systems, extremum seeking control, and safety for nonlinear systems. Recently, I've found fascination in age-structured models of population dynamics, which prove valuable in describing phenomena such as epidemics, chemostats, predator-prey relationships, and various ecological growth processes. Engaging as an active participant in our dynamic academic community brings me genuine satisfaction!

Q: It could be challenging to start as a new faculty member. What are your suggestions about how to grow an academic career for new faculty colleagues of our community?

A: Thank you for this excellent question. Having started my journey as a new faculty member twice, I was fortunate on both occasions to have wonderful collaborative colleagues who greatly facilitated the transition. In my experience, for new assistant professors, actively engaging with professional societies and program managers of funding agencies has proven to be valuable in starting a career. Our community plays a crucial role in enabling us to strive beyond what we could achieve as individuals.

Q. Thank you for your sharing!

A: Thank you for the opportunity and for the great work with the Newsletter.

Honors and Awards

Professor Miroslav Krstic won the triennial 2023 IFAC Adaptive and Learning Systems Award

Miroslav Krstic has been awarded the triennial 2023 IFAC Adaptive and Learning Systems Award. He has previously been the recipient of IFAC's triennial Nonlinear Control Systems Award and was the inaugural recipient of IFAC's triennial Distributed Parameter Systems Award, established in honor of late Ruth Curtain.

Professor Junmin Wang elevated to IEEE Fellow

Junmin Wang, a professor in the Walker Department of Mechanical Engineering, has been elected as an Institute of Electrical and Electronics Engineers (IEEE) Fellow. Wang is receiving this honor for his contributions to ground vehicle safety.

Wang has a wide range of research interests covering control, modeling, estimation, optimization, and diagnosis of dynamical systems, especially for automotive, vehicle, transportation, smart, automated, and sustainable mobility applications. His research contributions include the development of control and estimation methods that advance efficiency, cleanliness, and driving safety of conventional, electrified, connected and automated vehicles.

Additionally, Wang was elected as an American Society of Mechanical Engineers (ASME) Fellow in 2016 and a Society of Automotive Engineers (SAE) Fellow in 2015.

Bryan Maldonado, the Most Promising Scientist with a PhD in National Laboratories

Bryan Maldonado, a dynamic systems and controls researcher in the Buildings & Transportation Science Division at Oak Ridge National Laboratory, was recognized by the 2023 Hispanic Engineer National Achievements Awards Conference, or HENAAC, with the award for Most Promising Scientist with a PhD in National Laboratory for distinguished technical achievements as an early career researcher bridging multiple applied energy research fields through the development and application of novel artificial intelligence–based controls for building technologies, internal combustion engines, and in support of the operation of ORNL's Spallation Neutron Source.

Professor Azim Eskandarian named dean of the VCU College of Engineering

Azim Eskandarian, D.Sc., has been named Alice T. and William H. Goodwin Jr. Dean of the VCU College of Engineering, effective Aug. 1. Eskandarian currently serves as department head and Nicholas and Rebecca des Champs Professor of Mechanical Engineering in the College of Engineering at Virginia Tech.

Eskandarian's career includes experience in academic leadership, research, scholarship and teaching, as well as industry. Serving as department head at Virginia Tech since 2015, he has worked collaboratively within the department and college to enhance innovation and degree programs, improve services, enhance diversity, increase enrollment and external funding, and advance faculty and student success.

Upcoming Conferences

7th IEEE International Conference on Industrial Cyber-Physical Systems

St. Louis, USA, May 12-15, 2024

icps2024.ieee-ies.org

2024 European Control Conference

Stockholm, Sweden, June 25-28, 2024

https://ecc24.euca-ecc.org/

2024 American Control Conference

Toronto, Canada, July 8-12, 2024

https://acc2024.a2c2.org/

2024 IEEE/ASME International Conference on Advanced Intelligent Mechatronics

Boston, MA, USA, July 15-18, 2024

https://aim2024.org/

6th Annual Learning for Dynamics Control Conference

Oxford, UK, July 15-17, 2024

https://l4dc.web.ox.ac.uk

20th IFAC Symposium on System Identification

Boston, USA, July 17-19, 2024

https://conferences.ifac-control.org/sysid2024/

2024 International Symposium on Mathematical Theory of Networks and Systems

Cambridge, UK, Aug. 19-23, 2024

https://mtns2024.eng.cam.ac.uk

8th IEEE Conference on Control Technology & Applications

Newcastle upon Tyne, UK, August 21-23, 2024

https://ccta2024.ieeecss.org/

4th Modeling, Estimation and Control Conference

Chicago, Illinios, USA, October 27-30, 2024

https://mecc2024.a2c2.org

Openings and Calls

Faculty Opening at Kettering University

Kettering University is hiring a tenure-track Assistant Professor of Mechanical Engineering, with a specific focus in the area of dynamic systems. Preferred qualifications include experience in mechatronics and controls, demonstrated excellence in teaching at the undergraduate and graduate level, and demonstrated excellence in research and other scholarly activity. Required qualifications include:

- Ph.D. in mechanical engineering or closely related field (ABD with completion by time of appointment will also be considered);
- Ability to teach undergraduate and graduate courses in dynamic systems and controls, robotics, mechatronics, autonomous vehicles, and advanced mobility systems;
- Ability to use modern engineering tolls for teaching and research;
- Ability to develop an externally funded applied-research program;
- Demonstrated written and oral communication skills in the English language;
- Ability and desire to contribute through department, university, community and professional service work.

Apply at the following link:

https://jobs.kettering.edu/postings/8660

Kettering University is a national leader in experiential STEM and business education, integrating an intense academic curriculum with applied professional experience. We inspire students to realize their potential and advance their ideas by combining theory and practice. Every aspect of our work is guided by our True Kettering values.

RESPECT for teamwork, honesty, encouragement, diversity, and partnerships with students.

INTEGRITY including accountability, transparency and ethics.

CREATIVITY fostering flexibility and innovation.

COLLABORATION across disciplines and with all partners.

EXCELLENCE in all we do.

Kettering University is located in Flint, Michigan, a city with a storied past and an innovative approach to the future drives Flint forward. No other city of Flint's size can boast similar cultural and social resources; the Flint Institute of Art, Flint Symphony Orchestra, the Flint Institute of Music, the Sloan Museum, the Flint Farmers' Market, and several colleges and universities contribute to a rich social fabric. A vibrant array of dining, entertainment, and lodging options now enliven the walkable Flint city center. Kettering University is an important partner in the renaissance of Flint.

Opening for Biomedical/Electrical/Mechanical Engineer Research Fellow

An NSF Scholar-in-Residence (SiR) Research Fellow position for a biomedical / electrical / mechanical engineer is available in the Laboratory for Control and Information Systems at University of Maryland. The Research Fellow will join a project in collaboration with the Division of Biomedical Physics, Office of Science and Engineering Laboratories, U.S. Food and Drug Administration (FDA) and work at FDA to conduct research under an FDA mentor.

The candidate will join a research team studying regulatory science questions to advance photoplethysmography (PPG)-based blood pressure monitoring devices. The candidate will work closely with other team members on a project to develop and determine best practices in the design, evaluation, and use of mock circulation flow loops and tissue mimicking optical phantoms as potential bench platforms for testing of PPG-based blood pressure monitoring systems. The selected candidate will be involved in and learn about developing bench testing methods, computational modeling for simulation of various motion conditions, writing/maintaining software documentation, developing scientific manuscripts, and contributing to future research study design.

The selected candidate with other team members will develop a mock circulation flow loop for realistic in vitro replication of circulatory conditions. The candidate will be also working on developing an optical pulsatile tissue phantom. The flow phantom circuit technology will be presented as a nonclinical testing platform capable of performing bench testing of PPG-based blood pressure monitoring devices.

Desired Skills & Experience

- PhD degree in biomedical engineering, electrical engineering, mechanical engineering, or a related field with a strong interest in biomedical research career;
- Technical background and experience in cardiovascular systems physiology and biomedical optics;
- Familiarity with computational analysis of physiological signals (e.g., PPG signals);
- Experience in designing, evaluating, and implementing tissue mimicking optical phantoms;
- Programming skills in high level languages (e.g., Matlab).

How to Apply?

To apply, submit a cover letter describing background/skills/interests and a resume/CV addressed to Professor Jin-Oh Hahn at University of Maryland (jhahn12@umd.edu) with the e-mail subject, “NSF-SiR Research Fellow Application – Last Name, First Name”. As part of conducting research at FDA, the postdoctoral researcher will need to meet security requirements which include a background check and a minimum of three (3) out of the past five (5) years' residency status in the US.

Postdoc Opening at ORNL

OAK RIDGE National Laboratory

Exciting postdoctoral opportunity at ORNL! Join the research team at the ORNL's Spallation Neutron Source to optimize systems using AI techniques, boosting accelerator performance for increased neutron production. Requirements include a PhD in a relevant field, a strong background in optimization, diagnostics, or prognostics, and a passion for applying AI to real-world challenges. More information here: https://jobs.ornl.gov/job/Oak-Ridge-Postdoctoral-Research-Associate-Machine-Learning-for-Complex-System-Prognostics-and-Diagnostics-TN-37830/1079387200/

Focused section in the International Journal of Intelligent Robotics and Applications

Submission deadline is Ongoing.

https://link.springer.com/collections/djdfgbfdai Focused Section on Advances in Robotics and Artificial Intelligence for Minimally Invasive Surgery

In recent decades, robot-assisted minimally invasive surgery has witnessed remarkable progress, driven by cutting-edge technologies like artificial intelligence, advanced imaging technologies, and smart robotics. These advancements have paved the way for more clinically applicable robotic surgical applications. However, there remain challenges related to safety, intelligence, and effectiveness that can be addressed through the development of advanced robotic solutions. This special issue aims to showcase recent advancements, address challenges, and explore novel solutions in the fields of robot-assisted minimally invasive surgery, including novel mechanisms, sensing, perception, and control approaches to promote the applications of surgical robotics.

Potential topics of interests for this focus section include but are not limited to:

- Novel mechanisms, mechatronics, sensors, and actuators for surgical robotics;
- Continuum/soft robots for enhanced surgical performance and versatility;
- Force sensing/feedback technologies and haptic interfaces for precise and immersive surgeries;
- Image-guided robot-assisted minimally invasive interventions and surgeries;
- Machine learning and reinforcement learning applications in robot-assisted surgery;
- Real-time perception and decision-making algorithms for surgical robots;
- Human-robot interaction and collaboration in surgical environments;
- Integration of emerging technologies (e.g., AI, VR/AR) in robotic surgery;
- Simulation-based training and skill assessment for robot-assisted surgery;
- Intelligent automation and autonomy in surgical robotics;
- Advancements in surgical planning and navigation using robotic systems

The 7th IEEE International Conference on Industrial Cyber-Physical Systems

ICPS 2024

May 12-15, 2024, St. Louis, USA

Website: icps2024.ieee-ies.org

CALL FOR PAPERS

The 7th IEEE International Conference on Industrial Cyber-Physical Systems (ICPS) will be held from Sunday to Wednesday**, May 12-15, 2024**, St. Louis, MO, USA.

ICPS 2024 aims to provide an international platform for cutting edge research and professional interactions for the development of Industrial Cyber-Physical Systems. Industry experts, researchers and academics will share ideas and experiences surrounding frontier technologies, breakthroughs, innovative solutions, research results, as well as initiatives related to Industrial Cyber-Physical Systems and their applications. The conference will feature a rich program including industry talks, research papers, as well as workshops and special sessions.

A number of Special Sections in leading IEEE Journals such as TII, TICPS, OJIES and JESTIE, elaborating conference topics will be generated after the event. Authors of accepted papers, with excellent reviews, will be invited to submit an improved version of their papers for further consideration.

Topics within the scope of the conference (but not limited to):

- **ICPS Architectures & Engineering:** Industry Architectures, Industry Standards, RAMI 4.0, Industrial IoT, Engineering Methods and Tools, Lifecycle Management, Integration, HMI, Safety, Engineering Systems of ICPS, Standards, Development/Engineering Best Practices
- **ICPS Theory and Technologies:** Core Technologies, Security & Trust, Interoperability, Communication Networks, Connectivity OT/IT, Semantics, Control, Information Processing, Security, IoT/IoS, Cloud-Fog Computing, Big/Smart Data, Simulations
- **ICPS Automation and Autonomy:** Automation within ICPS Context for Industries (Agriculture, Healthcare, Factory, Maintenance, Manufacturing, Retail, Service, Supply chains), ICPS-Based Autonomous Systems, Robotics in Industries
- **ICPS Energy:** Cyber-Physical Energy System Design and Operation, Renewable Energy, Energy Storage, Power Trains, Electric Vehicles, Microgrid, Smart Grid
- **ICPS Advanced Modeling, Control, and Optimization:** ICPS System Modeling, Control Theory and Applications, System Optimization and Control
- **ICPS Emerging Applications:** Smart Manufacturing, Smart Cities, Smart Home and Living, Smart Framing, Mobility, Water Management, Mining, Oil & Gas, Intelligent Enterprise, Smart Transportation, Internet of Underwater Things, Smart Medical Systems
- **ICPS Education, Management, and Society:** Digital Skills, Education Curricula, Lifelong Learning & Training, Digital Society, Future of Work, Innovation Management, Visions/Roadmaps, Industry Digitalization, Strategies & Markets, Entrepreneurship, Strategic Impact, Societal Implications, Sustainability, Innovation Management, Innovation Ecosystems, Visions/Roadmaps
- **Artificial Intelligence in ICPS:** Machine Learning, Generative AI, Metaverse, LLMs, NLP, AI Explainability, Edge AI, Neuromorphic Computing, Foundation Models, Synthetic Data, Industrial Experiences

Special Sessions: Prospective participants of ICPS 2024 are encouraged to propose (and upon approval organize) special sessions in the focus areas under the symposium topics.

Tutorials: Several tutorials are planned on the latest trends in ICPS. Prospective speakers should apply asap.

Paper Submission:

Prospective paper authors are requested to electronically submit full papers in English following the instructions available on the conference website. Accepted and presented papers will be copyrighted by IEEE and published in conference proceedings, which will be eligible for inclusion in the IEEE Xplore online Digital Library and EI Compendex database.

Important Dates

Special Session Proposal:	Jan. 5, 2024
Full Paper Submission:	Jan. 15, 2024
Tutorial Proposal:	Jan. 15, 2024
Decision Notification:	Feb. 25, 2024
Early Registration:	Apr. 1, 2024

St. Louis is the second-largest city in Missouri, United States. It is located near the confluence of the Mississippi and the Missouri Rivers. Travelers looking for cosmopolitan fun, excitement and adventure will discover a great fit in St. Louis. Located in the midwestern USA, St. Louis is sophisticated yet affordable with a variety of attractions, exhibits and cuisine, all wrapped in a friendly, diverse atmosphere.

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The 2024 IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM2024) will be held on **July 15-18, 2024 in Boston, MA, USA** (https://aim2024.org/). As the flagship conference on intelligent mechatronic systems, AIM 2024 will bring together the international mechatronics community to discuss cutting-edge research results, expert perspectives on future developments, and innovative applications in mechatronics, robotics, automation, industrial electronics, and related areas.

The sponsors and organizers of AIM 2024 invite submissions describing original work, including but not limited to the following topics: Actuators, Automotive Systems, Bioengineering, Data Storage Systems, Electronic Packaging, Fault Diagnosis, Human-Machine interfaces, Human-Robot Interaction/Collaboration, Human Factors in Mechatronics Systems, Industry Applications, Information Technology, Intelligent Systems, Machine Vision, Manufacturing, Micro Electro-Mechanical Systems, Micro/Nano Technology, Modeling and Design, System Identification and Adaptive Control, Motion Control, Vibration and Noise Control, Neural and Fuzzy Control, Opto-Electronic Systems, Optomechatronics, Prototyping, Real-Time and Hardware-in-the-Loop Simulation, Robotics, Sensors, System Integration, Transportation Systems, Smart Materials and Structures, Energy Harvesting, and other frontier fields.

We invite high-quality submissions in the categories below. All submissions must be uploaded to the submission website: http://ras.papercept.net/conferences/scripts/start.pl following the schedule below.

Contributed: All papers go through a rigorous peer-review review process. All accepted manuscripts must be presented by the authors at the conference, will be published in the conference proceedings, and will be submitted for inclusion in IEEEXplore, subject to formatting and copyright requirements.
Invited: Invited sessions consist of 4 to 6 thematically related invited papers that will be presented together at the conference. Invited session proposals must include a brief statement of purpose and extended abstracts of the included invited papers. Invited papers are submitted and reviewed following the same process as contributed papers, and are included in the proceedings.1
Workshops: Half-day or full-day workshops will be in one of two categories: (1) *Tutorial Workshops* focused on educating attendees about an emerging topic and (2) *Research Workshops* focused on bringing together experts to discuss an emerging field. Tutorial and workshop proposals must include a statement of objectives, a description of the intended audience, and a list of speakers with an outline of their planned presentations. Unless specifically requested, individual tutorial and workshop presentations are not peer reviewed, and do not appear in the proceedings.
Special Sessions: Special sessions will be organized to give exhibitors, organizations, and attendees a venue to discuss specialized, new, and not strictly technical topics (such as products) that do not fit in the other submission categories. Special Session proposals must include an abstract of the special session.
Late Breaking Results: Poster presentations on late-breaking mechatronics research results will be presented during the conference. Note that the deadline for posters is much later than the deadline for papers, allowing presenters to share their most recent results. Posters will be peer-reviewed.
TMECH/AIM Focused Section and TMECH Presentation-Only: TMECH authors have two opportunities to share your work at AIM2024. (1) *Presentation Only:* All authors of TMECH papers accepted between Feb. 16, 2023 and Feb. 15, 2024 have the option to present their work during the conference. (2) *Focused Section:* Submissions to the 5th Edition of the Focused Section on TMECH/AIM Emerging Topics will go through the TMECH review process and, if accepted, are presented at AIM2024 and published as part of the focused section in the August 2024 issue of TMECH. Inclusion in the focused section requires paid registration and presentation. Papers rejected for publication in TMECH will automatically be considered by the Program Committee of AIM 2024 for inclusion in AIM2024 as a contributed paper. Details are available on a supplemental call for papers available on the conference website: https://aim2024.org/ and the TMECH website http://www.ieee-asme-mechatronics.info/.

IMPORTANT DATES:

TMECH/AIM Focused Section:	January 20, 2024
Invited/Workshop/Special Session Proposals:	January 27, 2024
Contributed and Invited Papers and TMECH Presentation Only:	February 8, 2024
TMECH/AIM First Decision:	March 1, 2024
TMECH/AIM Revisions:	March 25, 2024
Notification of AIM and TMECH/AIM Paper Status:	May 1, 2024
Final Paper Submission:	May 10, 2024
Late-Breaking Submission:	May 16, 2024

IEEE/ASME TRANSACTIONS ON MECHATRONICS

Call for Papers

The Fifth Edition of Focused Section on TMECH/AIM Emerging Topics

Submissions are called for the Fourth Edition of Focused Section (FS) on TMECH/AIM Emerging Topics. This Focused Section is intended to expedite publication of novel and significant research results, technology and/or conceptual breakthroughs of emerging topics within the scopes of TMECH (www.ieee-asme-mechatronics.org), providing rapid access to the state-of-the-art of TMECH publications to the mechatronics community.

The submitted paper must not exceed 8 TMECH published manuscript pages, excluding photos and bios of authors, and will be subject to the peer review process by TMECH standard. All final accepted papers will be published in August Issue of TMECH in 2024, and will be presented in the 2024 IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM 2024, www.aim2024.org). The rejected papers from the submissions will be transferred to the Program Committee of AIM 2024 for further review and consideration as conference contributed papers.

The review process for submissions to this Focused Section will be conducted in up to two rounds with one Major/Minor Revision allowed, and the final decision falls into one of the following two categories:

1. Accept for publication in Focused Section. In this case, the paper will be accepted by AIM 2024 concurrently for presentation only, with full information of the paper included in the preprinted proceeding of AIM 2024. The final publication in TMECH, however, will be subject to the completion of presentation in AIM 2024 with full registration fee paid.
2. Reject for publication in Focused Section (after the first or second round). In this case, the paper, as well as all the review comments, will be forwarded to the Program Committee of AIM 2024 for further consideration. A final Accept/Reject decision will then be made by the Committee as a conference contributed paper for AIM 2024.

Manuscript preparation
Papers must contain original contributions and be prepared in accordance with the journal standards. Instructions for authors are available online on the TMECH website.

Manuscript submission
Manuscripts should be submitted to TMECH online at: mc.manuscriptcentral.com/tmech-ieee, selecting the track 'TMECH/AIM Emerging Topics'. The cover letter should include the following statement: This paper is submitted to the Fourth Edition of Focused Section on TMECH/AIM Emerging Topics. The full information of the paper should be uploaded concurrently to AIM 2024 online at: ras.papercept.net/conferences/scripts/start.pl., noted with the given TMECH manuscript number in the designated area.

Submission/Review/Decision Timeline:

Opening Date of TMECH/AIM FS Submission Site (first submission):	November 1, 2023
Closing Date of TMECH/AIM FS Submission Site (first submission):	January 20, 2024
Full Information of TMECH/AIM FS Paper Submitted to AIM Site:	January 20, 2024
First Decision for TMECH/AIM FS Submission:	March 1, 2024
Revised TMECH/AIM FS Submission Due by:	March 25, 2024
Final Decision for TMECH/AIM FS Submission:	May 1, 2024
Final Version of TMECH/AIM FS Submission Due by:	May 20, 2024
Publication of Focused Section in TMECH:	August 2024

Contacts: For any questions related to this Call for Paper, please contact:
Qingze Zou, qzzou@soe.rutgers,edu, Senior Editor of TMECH,
Yan Wan, yan.wan@uta.edu, Program co-Chair of AIM 2024.

2024 Modeling, Estimation and Control Conference

October 27-30, 2024 (Sunday – Wednesday)
Intercontinental, Magnificent Mile, Chicago, Illinois, USA

MECC 2024 *Tentative* Key Dates

Joint paper submission deadline: March 15, 2024
Deadline for submission of papers: April 02, 2024
Notification of acceptance/rejection: June 18, 2024
Final manuscript submission deadline: July 16, 2024

MECC 2024 Chicago

The 2024 Modeling, Estimation and Control Conference (MECC 2024), sponsored by the American Automatic Control Council (AACC) and co-sponsored by the International Federation of Automatic Control (IFAC), will be held on Sunday-Wednesday October 27-30, 2024, at the Intercontinental, Magnificent Mile, Chicago, Illinois, United States. On behalf of the MECC 2024 Organizing Committee, AACC, and IFAC, we cordially invite you to participate in the conference and enjoy a unique opportunity to network with colleagues.

MECC 2024 aims to serve the scientific and engineering communities with interests in the modeling, estimation, and control of cross-disciplinary mechanical systems; to provide a platform for the dissemination and discussion of the state of the art in relevant research areas; and to create opportunities for networking with colleagues. The conference features conference awards, contributed sessions, invited sessions, workshops, special sessions, plenary talks, keynote speeches, student programs, as well as committee meetings, industry programs, and social functions.

MECC 2024 invites (1) manuscripts that report original research on all aspects of modeling, estimation, and control; and (2) proposals for invited, special, and tutorial sessions, and workshops on emerging topics. Exhibits from both industries and research labs are welcome. MECC 2024 is pleased to offer a joint submission process, in collaboration with the ASME Letters in Dynamic Systems and Control (L-DSC) and ASME Journal of Dynamic Systems, Measurement, and Control (JDSMC). Manuscripts submitted through this joint process (by March 15, 2024) will be considered for peer-reviewed publication in the journal selected by the authors. Manuscripts not selected for journal publication will receive secondary consideration for inclusion in the peer-reviewed MECC proceedings. Alternatively, authors can submit manuscripts directly for consideration as peer-reviewed MECC proceedings publication (by April 05, 2024). For more detailed information, please stay tuned and check the conference website: https://mecc2024.a2c2.org. All accepted papers must be presented on-site at the conference by an author of the paper.

Registration discounts will be offered to all members of AACC, IFAC, and their member societies such as AIAA, AIChE, APS, ASCE, ASME, IEEE, ISA, SCS, and SIAM.

All publication material submitted for presentation at MECC 2024 must be original and hence cannot be already published, nor can it be under review elsewhere. The authors take responsibility for the material that has been submitted. MECC 2024 will abide by the highest standard of ethical behavior in the review process. Additional details regarding the MECC 2024 publication process will be posted on the conference website (to be released soon), so please stay tuned: https://mecc2024.a2c2.org.

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