John H Bell, Ph.D.

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SUMMARY

Roboticist and mechanical engineer with extensive expertise in dynamic systems modeling, advanced actuator design, and real-time control algorithms. Proven ability to bridge mechanical design with sophisticated modeling approaches, including predictive modeling and human-robot interaction systems. Strong analytical foundation in applied mathematics, proven through rigorous research and practical implementations. Experienced collaborator with demonstrated effectiveness in teaching complex engineering concepts and leading multidisciplinary project teams.

EDUCATION

Massachusetts Institute of Technology   Cambridge, MA
Doctor of Philosophy in Mechanical Engineering, with a Minor in Applied Mathematics   2025
  Dissertation: "Dynamic modeling and intervention design for the sit-to-stand transition
  using Koopman lifting linearization" (Advisor: H. Harry Asada)

Master of Science in Mechanical Engineering   2020
  Thesis: "A two-motor actuator for legged robotics applications" (Advisor: H. Harry Asada)

Bachelor of Science in Mechanical Engineering, with a Minor in Philosophy   2018
  Thesis: "Non-invasive system identification of a tactical generator" (Advisor: Marija Ilić)

SKILLS

Core: Control system design, dynamic system modeling, design for manufacturing, experimental design
Programming Languages: Python, MATLAB, Java; C++ in embedded systems
Software: SolidWorks (CAD, Motion Analysis, FEA), NI LabVIEW, HSMWorks, Mastercam
Languages: English and Spanish (native proficiency)

RESEARCH EXPERIENCE

Massachusetts Institute of Technology   Cambridge, MA
Graduate Researcher   Aug 2018 – Present
- Developed predictive models of human movement to be integrated into model-predictive control of robots for human-robot collaboration
- Engineered real-time control algorithms for controlling novel dual-motor actuator systems at a wide bandwidth, while also applying sufficiently large forces to support a human
- Designed and implemented human mental state estimation to enable effective human-robot collaboration, facilitating safe and efficient support of an elderly human by a support robot
- Led the design and execution of human-subject experiments, systematically evaluating human response to robotic assistance, informing the development of intuitive assistive robots
- Optimized actuator design for a human-support robot to achieve both high speed and high load task requirements

Undergraduate Researcher   Feb 2016 – Jan 2017
- Developed stochastic differential equation models to simulate power grid systems with wind power penetration
- Applied Fokker-Planck probabilistic analysis to study the frequency stability of grids with primary control and deadbands

MIT Lincoln Laboratory   Lexington, MA
Intern   June 2017 – May 2018
- Designed and executed experiments to develop a dynamical system model for synchronous machine electric generator
- Applied frequency-domain and time-domain analysis to study the stability of microgrids containing synchronous machines and renewable energy sources

LEADERSHIP AND SERVICE

MIT MechE MakerWorkshop Makerspace   Cambridge, MA
President   June 2019 – May 2020
- Led the executive committee in managing the week-to-week operations of the shop and facilitating the student community
- Negotiated with the MIT AeroAstro and MechE department faculty leadership to expand shop access to include AeroAstro students and faculty, balancing the stakeholder interests of both departments
- Oversaw a team of student mentors in the design of a January-term course in computer-aided design (CAD), targeted at MechE sophomores. Based on a successful pilot, MIT launched this as a credit-offering class.

CNC Router Machine Master   June 2016 – May 2019 and May 2021 – Aug 2023
- Led a team of mentors in maintaining the CNC router machine and giving trainings to shop users and mentors
- Developed new training procedures for teaching students, staff, and faculty how to use the CNC router

Mentor   Dec 2015 – Aug 2023
- Advised shop users on integrating the variety of machine tools to achieve their design goals effectively and safely

TEACHING EXPERIENCE

Massachusetts Institute of Technology   Cambridge, MA
Graduate Teaching Assistant   Sep 2021 – Dec 2024
- Designed a class project for teaching Simultaneous Localization and Measurement (SLAM) to graduate students
- Facilitated 6 undergraduates in applying the user-centered product design process to toy design
- Implemented a "mud card" student feedback system and prior knowledge polls to adapt lecture and recitation content to student needs in real time

PUBLICATIONS

"Monitoring the Mental State of Cooperativeness for Guiding an Elderly Person in Sit-to-Stand Assistance,"
  Bell, JH and Asada, HH, *2022 International Conference on Robotics and Automation (ICRA)*,
  Philadelphia, PA, USA, 2022.

"Gear Ratio Optimization of a Multifunctional Walker Robot Using Dual-Motor Actuation,", **Bell, JH**, Kamienski,
  E, Teshigawara, S, Itagaki, H, and Asada, HH, *2021 IEEE/RSJ International Conference on Intelligent
  Robots and Systems (IROS)*, Prague, Czech Republic, 2021.

"Design and Time-Optimal Control of a High-Speed High-Torque Dual-Motor Actuator," **Bell, JH** and Asada,
  HH, 2020 *American Control Conference (ACC)*, Denver, CO, USA, 2020.

"Deadbands, Droop, and Inertia Impact on Power System Frequency Distribution," Vorobev, P, Greenwood,
  DM, **Bell, JH**, Bialek, JW, Taylor, PC, and Turitsyn, K, in *IEEE Transactions on Power Systems*, vol.
  34, no. 4, pp. 3098-3108, July 2019.

"Localized Instabilities of Liquid Metal Films via In-Plane Recapillarity," Khan, MR, **Bell, JH**, and Dickey, MD,
  in *Advanced Materials Interfaces*, 3: 1600546, 2016.