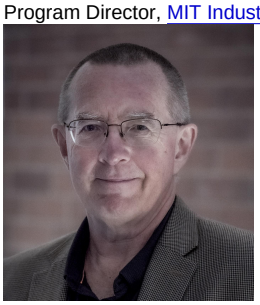
MIT Industrial Liaison Program Faculty Knowledgebase Report

Advanced Design & Manufacturing

October 10, 2024 9:30 am - 12:30 pm

9:30 AM

Introduction
Steve Whittaker
Program Director, MIT Industrial Liaison Program



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Steve Whittaker has almost 40 years' of experience in R&D, innovation, and strategy. He has a background in computer science and AI, coupled with very broad interests in emerging technologies and their impact on individuals, organizations, and society.

Before joining MIT, Steve was responsible for BT's partnerships with US research universities and business schools. He was recently awarded the inaugural MIT CSAIL Connector Award for industry partnerships, and he was a resident visiting scientist/research affiliate at the MIT Media Lab for more than a decade.

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9:40 AM

The Human Opportunity – Building a Skilled Technologist Workforce

John Liu

Principal Investigator, MIT Learning Engineering and Practice (LEAP),
Digital Learning Lab Scientist and Lecturer, MIT Department of Mechanical Engineering

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John Liu is a Principal Investigator of the MIT Learning Engineering and Practice (LEAP) Group, which applies design principles to solving challenges to better meet the increasing demand for STEM skills in tomorrow's workforce. He is a Digital Learning Lab Scientist and Lecturer in MIT's Mechanical Engineering department. He leads education and workforce development efforts for MIT's new initiative: Manufacturing@MIT. He was the Director of the Principles of Manufacturing MicroMasters program, an online certificate program that has now enrolled over 200,000 learners across the globe. Dr. Liu's work includes engineering education, mixed reality and haptic experiences, workforce solutions to address the nation-wide manufacturing skills need, open-ended assessments for scalable education settings, and instructional design theory for massively open online courses. He received Best Paper Awards at the American Society Engineering Education (ASEE) in 2020. Dr. Liu earned his B.S. in Applied Physics from Caltech and S.M. and Ph.D. in Mechanical Engineering from MIT, under an MIT-SUTD fellowship and NSF Graduate Research Fellowship

Engineers, who know systems and processes, are generally separated from operators, who are often only trained on specific machines. New manufacturing technologies, whether in robotics or digital production, are transforming factory floors. Advanced manufacturing requires workers with a technician's practical know-how and an engineer's comprehension of processes and systems. Companies that want to move into advanced manufacturing often struggle to find people who know how to integrate technologies to optimize the whole system, manage technological advances, and drive innovation. We call this worker the "technologist." As advanced technological manufacturing progresses, technologists will be essential in the adoption of next-generation factory systems. We believe that training programs for technologists can empower both incumbent and aspiring workers to be knowledgeable, productive, and adaptable contributors to a more robust US manufacturing economy (Liu & Bonvillian, 2024). MIT is excited to provide pathways for employees to advance in their careers, create training that allows companies to fill key roles, and build a workforce that will strengthen America's industrial base.

10:00 AM

The State of Global Manufacturing – Obstacles and Opportunities towards Advanced Manufacturing and Design

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Investing in the Future of Manufacturing and Operations: Practical Applications of AI and Analytics for Competitive Advantage

Bruce Lawler

Managing Director, MIT Machine Intelligence for Manufacturing and Operations

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Managing Director
MIT Machine Intelligence for Manufacturing and Operations

Bruce Lawler is a technology entrepreneur and executive leader with consecutive public and private exits, and early stage investing success with leading venture firms including Accel, CRV, KPCB, Redpoint, Sequoia, and Softbank. He is an industry thought leader and public speaker with development expertise in mobile applications, SaaS, artificial intelligence systems and video distribution networks; and an operations executive with experience ranging from consumer and industrial hardware/electronics manufacturing to wireless and video network operations (DevOps). Bruce is also President of ReBuild Digital where he is focused on rebuilding America's manufacturing base and creating meaningful, sustainable jobs through the application of digital technologies.

In 1998 Bruce founded a company to deliver digital video over the internet and had a successful IPO 2 years later. In 2001 he founded a venture capital firm focused on investing in mobile phone technology. He invested in other successful entrepreneurs like Andy Rubin, the creator of Android. In 2003 he founded a company to write applications for mobile phones which he recently sold to Motorola.

Bruce began his career in Artificial Intelligence as a COMMON LISP developer at ICAD where he helped to automate design and manufacturing for companies that included Boeing, Airbus, GM, GE, Northrop Grumman and Ford. He also helped fast track the porting of ICADs core platform from LISP/Symbolics to C++/SUN. At Kodiak, Bruce led the development of the Kodiak Business Intelligence, a data visualization and analytics platform now used by Motorola.

Bruce attended Purdue University where he received his Bachelor's degree in Engineering specializing in electro-mechanical control systems and was a President's Honor Award recipient. In 1990 he was awarded the LGO Fellowship to attend MIT, where he obtained both a Master of Science in Engineering and an MBA from MIT's Sloan School.

Explore practical and successful applications of analytics and AI in manufacturing across small, medium, and large enterprises in the U.S. Learn where to invest to start and sustain a digital transformation journey, drawing on research and best practices from MIT and McKinsey. Discover impactful uses of Generative AI currently shaping the industry that will drive future investment.

11:05 AM

The Biomanufacturing Opportunity
J. Christopher Love

Raymond A. (1921) and Helen E. St. Laurent Professor, MIT Department of Chemical Engineering,
Member, Koch Institute for Integrative Cancer Research at MIT,
Associate Member, Broad Institute of MIT and Harvard,
Associate Member, Ragon Institute of MGH, MIT, and Harvard

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J. Christopher Love is Professor of Chemical Engineering and a member of the Koch Institute for Integrative Cancer Research at MIT. He is also an Associate Member of the Broad Institute, and an Associate Member at the Ragon Institute of MGH, MIT, and Harvard. Love earned a BS in chemistry from the University of Virginia and a PhD in physical chemistry at Harvard University under the supervision of George Whitesides. Following completion of his doctoral studies, he extended his research into immunology at Harvard Medical School with Hidde Ploegh from 2004-2005, and at the Immune Disease Institute from 2005-2007. Dr. Love has been named a W.M. Keck Distinguished Young Scholar for Medical Research (2009), a Dana Scholar for Human Immunology (2009), and a Camille Dreyfus Teacher-Scholar. Prof. Love served as a Distinguished Engineer in Residence at Biogen from 2015-2016. He has co-authored more than 100 manuscripts and is an inventor on multiple patents.

Professor Love is co-founder of OneCyte Biotechnologies, HoneyComb Biotechnologies, and Sunflower Therapeutics. He serves as an advisor to SQZ Biotechnologies, Repligen, QuantrumCyte, and other companies.

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Biotechnology is poised to enable entirely new manufacturing in the 21st century. The rapid advances in synthetic biology and genome-scale biology are powering new capabilities to make a range of products from basic chemicals to uniquely biologically-enabled products like tissues. Combining these 'front-end' technologies with emerging 'back-end' elements like continuous and integrated operations, automation, and AI/ML can enable new models for accessible biomanufacturing capacity. Growing new capabilities for biomanufacturing could transform the industrial base to enable circular bioeconomies that are both sustainable and prosperous.

11:30 AM

Utilizing AI for Advanced Design

Faez Ahmed
ABS Career Development Assistant Professor, MIT Department of Mechanical Engineering

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ABS Career Development Assistant Professor
MIT Department of Mechanical Engineering

Prof. Faez Ahmed is the ABS Career Development Assistant Professor in the Department of Mechanical Engineering at the Massachusetts Institute of Technology (MIT). He leads the Design Computation and Digital Engineering (DeCoDE) lab, with a research focus on the synergy of machine learning and engineering design. His recent work addresses the synthesis of designs tailored to real-world constraints and promotes the collaborative potential between human designers and machines. Prior to his appointment at MIT, Prof. Ahmed was a postdoctoral fellow at Northwestern University and earned his Ph.D. in Mechanical Engineering from the University of Maryland. He has industrial experience in Australia's railway and mining sectors, where he championed data-driven predictive maintenance initiatives. Prof. Ahmed's vision is to create a world where humans and AI design together to solve our biggest challenges.

Generative AI is reshaping many industries by offering innovative content-creation approaches. While tools like ChatGPT have proven effective in multimedia, their application in engineering faces unique challenges, such as maintaining precision under varying requirements. This talk will explore some of these challenges, with an emphasis on achieving designs that are innovative, feasible, and achieve high functional performance. We will examine case studies across various engineering disciplines, such as kinematic design. Furthermore, we will explore how precision-focused generative AI can transcend mere mimicking statistical patterns to address performance, constraints, and innovation in engineering. The talk will show examples of AI-drive design co-pilots for engineering tasks, along with covering methods that effectively combine multimodal generative models with engineering optimization and tools, highlighting how this fusion augments the design process. The presentation will conclude by highlighting the broader impact of generative AI in facilitating design democratization and fostering rapid innovation across the engineering sector.

12:00 PM

Panel Discussion
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12:30 PM	Adjournment