MANUFACTURING RESEARCH SEMINARS
SERIES: SMART MANUFACTUING

# Redesigning Manufacturing Machines, Design Tools, and Robotics for Smart Human Augmented Spatial Interfaces


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## Abstract


The convergence of many factors such as low-cost sensors, electronics, computing, fabrication, and more recently machine learning, aided by human interactive interfaces has created the potential to redesign our manufacturing ecosystem. I will describe three themes in our research. First is redesigning design tools and machines around humans to enabling easy access to manufacturing by non-experts. I will provide examples of transforming everyday objects to interactive objects, mixed dimensional modeling, and creating objects directly in the physical world. Second, I will show construction of reconfigurable modular robots and mixed reality interactions with new forms of distributed intelligence and an open system architecture, that can give rise to vastly new forms of smart machines, robotic structures, and functions. Furthermore, because these robots and machines can be programmed and controlled with just a mobile phone, the developers of such "low-cost" robotics and machine "apps" do not need programming experiences at all. It will transform high-tech to low-tech and make it accessible to small and medium scale industries. Third, I will demonstrate new forms of location-aware collaborative intelligence and information exchange between humans-robots and machines. In addition, new soft interface wearables will free hands to work and interact at the same time, enabling augmentation. With such possibilities, our factories can be more productive and agile by using cognitively intuitive, spatially aware, and easy to program interactive interfaces that aid the human(s)-robot(s)-machine(s) to work together. Our research directions in artificial intelligence-based human augmentation technologies will have a direct impact on workforce re-skilling programs, increasing human labor capacity, factory productivity, and agility.


## Bio

Karthik Ramani is the Donald W. Feddersen Professor of School of Mechanical Engineering at Purdue University, with courtesy appointments in Electrical and Computer Engineering and College of Education. He earned his B.Tech from the Indian Institute of Technology, Madras, in 1985, an MS from Ohio State University, in 1987, and a Ph.D. from Stanford University in 1991, all in Mechanical Engineering. He has received many awards from the National Science Foundation (NSF) and other organizations. He has served in the editorial board of Elsevier Journal of Computer-Aided Design (CAD) and the ASME Journal of Mechanical Design (JMD). In 2008 he was a visiting Professor at Stanford University (computer sciences), research fellow at PARC (formerly Xerox PARC). In 2016 summer he was visiting professor Oxford University Institute of Mathematical Sciences. He also serves on the Engineering Advisory sub-committee for SBIR/STTR for the NSF. In 2006 and 2007, he won the Most Cited Journal Paper award from CAD and the Research Excellence award in the College of Engineering at Purdue University. In 2009, he won the Outstanding Commercialization award from Purdue University. He was the co-founder of the world's first commercial shape-based parts search engine (VizSeek) and more recently co-founded ZeroUI whose product (Ziro) won the Best of Consumer Electronics Show Finalist (CES 2016). His research interests are in designing collaborative intelligence, human-machine interactions, spatial interfaces, deep shape learning and manufacturing productivity. He has published recently in ACM [CHI & UIST], IEEE [CVPR, ECCV, ICCV], ICLR, ICRA, Scientific Reports, and ASME JMD.

## Friday, February 15

11:00 - 12:00 PM

Chrysler Center
Room 151
2121 Bonisteel Blvd
Ann Arbor, MI 48109

Map to Chrysler Center

Metered parking is available on campus.

Co-organized by
Judy Jin (Professor, IOE) and
Chinedum Okwudire (Associate Professor, ME)

More Information?
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