

## PLENARY SESSION

Fellow IEEE-IFAC: **Tariq Samad**

Technological Leadership Institute  
University of Minnesota

Talk Title: **Automation, Autonomy, and Humans in the Loop:  
Advances in Control Systems**

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### Abstract

Control engineering has had tremendous impact on society, in application domains that span the range of engineered systems (aerospace, process industries, automotive, homes and buildings, biomedical, power systems, and others). I will highlight some of the successes of advanced control and quantify benefits achieved in industry. The results of a recent survey regarding which advanced control technologies have had the most impact will be presented (no surprise, model-predictive control heads the list, but there are surprises too). The principles of control, though, are relevant well beyond today's applications—indeed, at its core, control science is arguably the only rigorous approach to optimal decision making in uncertain, complex dynamical systems! In this context, I will discuss how progress in control systems has led to increasing autonomy in a certain sense, but complete autonomy for complex systems remains a chimera. Semi-autonomous—meaning human-in-the-loop—systems are where more attention needs to be directed. Examples that will be discussed include aviation, the process industries, smart grids, and management and innovation processes. An outstanding research need is for control-relevant “models” of people, as individuals as well as teams. Findings from prospect theory provide insights and will be reviewed, but much further work is needed. Human-in-the-loop automation and control is an exciting and open area for research.

### BIOSKETCH

Tariq Samad holds the Honeywell/W.R. Sweatt Chair at the Technological Leadership Institute at the University of Minnesota, where he also serves as the Director of Graduate Studies for the nation's longest-running M.S. in Management of Technology program and has an adjunct faculty appointment in the Department of Electrical and Computer Engineering. Dr. Samad joined TLI in 2016 after a 30-year career with Honeywell, for the last half of which he was Corporate Fellow with Honeywell Automation and Control Solutions (ACS). During his career with Honeywell he contributed to and led automation and control technology developments for applications in electric power systems, clean energy, building management, the process industries, automotive engines, unmanned aircraft, and advanced manufacturing. His research interests relate broadly to automation, intelligence, and autonomy for complex engineering systems. In 2015-2016 he also served as the first Global Innovation Leader for the business.

Dr. Samad was the President of the American Automatic Control Council for 2014-15 and the President of IEEE Control Systems Society in 2009. He is a Fellow of the IEEE and of IFAC and the recipient of a few awards including the 2008 IEEE CSS Control Systems Technology Award, a Distinguished Member Award from IEEE CSS, and an IEEE Third Millennium Medal. He is currently editor-in-chief of IEEE Press. He is the founding chair of the new Industry Committee for IFAC. Dr. Samad holds 20 patents and has authored or coauthored over 100 conference and journal publications. His edited publications include the online report *The Impact of Control Technology* (co-editor, [ieeecs.org/general/loCT2-report](http://ieeecs.org/general/loCT2-report)) and the *Encyclopedia of Systems and Control* (co-editor-in-chief, Springer, 2014). He was a founding member of the Board of Directors of the U.S. Smart Grid Interoperability Panel and he co-led technology deep dives on advanced sensing, controls, and platforms for manufacturing as part of the U.S. Advanced Manufacturing Partnership initiative. Dr. Samad holds a B.S. degree in Engineering and Applied Science from Yale University and M.S. and Ph.D. degrees in Electrical and Computer Engineering from Carnegie Mellon University.