Title: From stabilizing to economic Model Predictive Control: A paradigm shift towards increased control performance

Abstract: During the past decades model predictive control (MPC) has become a preferred control strategy for the control of a large number of industrial control problems from distillation control to autonomous driving. Computational issues, application aspects and systems theoretic properties of MPC (like stability and robustness) are rather well understood by now and the theory is well developed even for nonlinear systems. In standard MPC formulations, the considered control objective is typically the stabilization of some (given) setpoint or trajectory to be tracked. In contrast, the main focus in so-called economic MPC is on closed-loop performance where the cost to be optimized is related to some economic objective. This shift in the typical control task to be solved is of interest for many industrial applications. This concerns for example robot control, autonomous mobility, or industrial production processes in the framework of Industry 4.0.

In this presentation we will first give an introduction to and an overview over the general field of model predictive control. An account of the development of model predictive control theory for nonlinear systems will be given focusing on requirements for the stability of the nonlinear closed loop. Then economic MPC will be introduced and a tutorial overview of the system theoretic aspects of economic MPC will be presented highlighting the advantages for various application scenarios. Finally new results for distributed economic model predictive control for the control of networks of systems are presented.

Biography: Frank Allgöwer is director of the Institute for Systems Theory and Automatic Control and professor in Mechanical Engineering at the University of Stuttgart in Germany. Frank's main interests in research and teaching are in the area of systems and control with a current emphasis on the development of new methods for optimization-based control, networks of systems, data-based control and systems biology. Frank received several recognitions for his work including the IFAC Outstanding Service Award, the IEEE CSS Distinguished Member Award, the State Teaching Award of the German state of Baden-Württemberg, and the Leibniz Prize of the Deutsche Forschungsgemeinschaft.

Frank is President of the International Federation of Automatic Control (IFAC) for the years 2017-2020. He was Editor for the journal Automatica from 2001 to 2015 and is editor for the Springer Lecture Notes in Control and Information Science book series and has published over 500 scientific articles. Since 2012 Frank serves a Vice-President of the German Research Foundation (DFG).