

Department of Electrical and Computer Engineering

Title: “**Controllability and observability of rational systems**”

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Abstract:

A rational system is a control system as understood in control theory in which the differential equation and the output equation are formulated in terms of rational functions. A rational function is such that every component is the quotient of two polynomials. Rational systems are realistic models for biochemical reaction systems, for particular economic systems, and for models of control engineering. The interest in this subclass of nonlinear systems is also stimulated by knowledge of algebra and by the availability of tools for computational algebra. The lecture will provide characterizations of controllability and of observability of rational systems which are illustrated by simple examples. A first result is the existence of a realization of a rational system from an input-output map. A second result is that a realization is minimal if and only if it is both observable and controllable. A characterization of observability is that the observation algebra equals the algebra of all functions on the state set. Computational approaches for these conditions will be briefly discussed. This lecture is the first of a series of lectures on rational systems. The research is based on joint work with Jana Nemcova (Institute of Chemical Technology, Prague, Czech Republic).

Biography:

Jan H. van Schuppen is since 1 October 2012 affiliated as researcher with the the company Van Schuppen Control Research in Amsterdam and as professor emeritus with the Department of Mathematics of the Delft University of Technology in Delft, The Netherlands. Formerly he was primarily affiliated with the research institute Centrum voor Wiskunde en Informatica (CWI) in Amsterdam, The Netherlands. Van Schuppen's research interests include control of distributed and of multilevel systems, control of discrete-event systems and of hybrid systems, stochastic control, realization, and system identification. In applied research his interests include engineering problems of control of motorway traffic, and control and system theory for the life sciences. He is Advisory-Editor of the journal Mathematics of Control, Signals, and Systems (MCSS), was Associate Editor-at-Large of the journal IEEE Transactions Automatic Control, and was Department Editor of the journal Discrete Event Dynamic Systems. He was and is the advisor of 18 Ph.D. students, 12 post-docs, and 9 master level students. Finally, he was also the coordinator of the EU-financed C4C Project (CON4COORD, Grant agreement INFSO-ICT-223844).