Functional T-Observers

FRI/P3
10:30–10:50

Ingrid Blumthaler (Univ. Innsbruck)

The theory exposed in this talk is a contribution to behavioral observer theory which was started by M. E. Valcher and J. C. Willems in 1999 and which was recently exposed by P. Fuhrmann in a comprehensive survey article. It is also a further developement of our own work on pseudo state observers (Blumthaler and Oberst, 2009).

For a given continuous or discrete time linear time-invariant behavior (i.e., the solution module of a system of differential resp. difference equations) we assume that a function of a solution (e.g., some components) can be measured. We are interested in estimating another function of this solution.

We introduce the terms T*-observability* and T*-observer* where T is a multiplicatively closed subset of the ring of operators. For different choices of T, T-observability coincides with observability, reconstructibility, trackability, or detectability, a T-observer is an exact, dead-beat, tracking, or asymptotic observer. We show the equivalence of T-observability and the existence of T-observers and give a constructive parametrization of all T-observers.

Partial observation of the state of a Kalman state space system is a special case of our setting, and so are the observers of certain unknown components of a behavior studied by Bisiacco, Valcher, and Willems (1999, 2000, 2006). Other predecessors of our work are Wolovich (1974), Vidyasagar (1985) and Fuhrmann (2008).