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Structural and global identifiability for the classes of parametrized polynomial and parametrized rational systems

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Abstract The system identification problem is to obtain systems as realistic models of observed phenomena. The motivation to investigate system identification of polynomial and rational systems is the use of these systems as models of phenomena in life sciences, in particular in systems biology. For example, polynomial and rational systems occur as models of metabolic, genetic, and signaling networks.

In this talk we study structural and global identifiability of parametrized polynomial and parametrized rational systems. In particular, we derive necessary and sufficient conditions for parametrized polynomial and parametrized rational systems to be structurally or globally identifiable. These properties provide information whether the parameters of a parametrized system can be determined uniquely. Therefore, verifying at least one of these properties preceeds determination of numerical values of the parameters. Since analysis and simulation of biological phenomena require the availability of their fully specified models, one needs to be able to estimate the parameters of the models which are not fully determined.

The results are applied to investigate the identifiability properties of the system modeling a chain of two enzyme-catalyzed irreversible reactions. The other examples deal with the phenomena modeled by using Michaelis-Menten kinetics, and the model of a peptide chain elongation.