Positive solutions of parametric polynomial systems and biochemical reaction networks

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In the context of (bio)chemical reaction networks, the dynamics of the concentrations of the chemical species over time are often modelled by a system of parameter-dependent ordinary differential equations, which are typically polynomial or described by rational functions. The study of the steady states of the system translates then into the study of the positive solutions to a parametric polynomial system.

In this talk I will start by shortly presenting the formalism of the theory of reaction networks. Afterwards I will focus on the study of the parameter region where the relevant parametric system admits at least two positive solutions (a property termed multistationarity and of interest in the application). I will show recent results on how to describe the region and decide whether it is connected. The results exploit the connection between the Newton polytope of a multivariate polynomial and the signs the polynomial attains over the positive orthant.

The results I present arise from several joint works with Conradi, Kaihnsa, Mincheva, Telek, Yürük, Wiuf and de Wolff.