SONC Decompositions in Chemical Reaction Networks - An Empirical Approach

Birte Ostermann

Technische Universität Braunschweig
birte.ostermann@tu-braunschweig.de

Chemical reaction network theory models the dynamic behavior of biochemical processes through underlying parametrized ordinary differential equation systems. The notions of multi- and monotationarity determine if a network achieves multiple steady states or just one. Identifying which parametric reaction rate constants correspond to which of these notions is a difficult problem linked to the nonnegativity of a specific polynomial. For the dual phosphorylation network, a previous work by Feliu, Kaihnsa, de Wolff and Yürük provides a sufficient condition for monostationarity via a non-unique decomposition of this polynomial into sums nonnegative circuit polynomials (SONC). We extend their work by a systematic approach to classifying the SONC decompositions and comparing them through empirical experiments, thereby improving on previous conditions for the region of monostationarity in dual phosphorylation. This is joint work with May Cai and Matthias Himmelmann.