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Disguised toric dynamical systems. (English) Zbl 07517058

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A Euclidean embedded graph (or $E$-graph for short) is a digraph (directed graph) $G = (V, E)$, where $V$ is the set of vertices, $E$ is the set of edges with no self-loops and at most one edge between a pair of ordered vertices. The authors consider biochemical reaction networks as $E$-graphs (where $E$ is the set of reactions) and families of polynomial dynamical systems inspired by them. They focus on toric (i.e. complex balanced mass-action) systems. These systems are known or conjectured to enjoy very strong dynamical properties, such as existence and uniqueness of positive steady states, local and global stability, persistence, and permanence. The authors consider the class of disguised toric dynamical systems, which contains toric dynamical systems, and to which all dynamical properties mentioned above extend naturally. By means of (real) algebraic geometry they show that some reaction networks have an empty toric locus or a toric locus of Lebesgue measure zero in the parameter space, while their disguised toric locus is of positive measure. They also propose some algorithms one can use to detect the disguised toric locus.

Reviewer: Vladimir P. Kostov (Nice)

MSC:

14P05 Real algebraic sets
14P10 Semialgebraic sets and related spaces
14Q30 Computational real algebraic geometry
34D23 Global stability of solutions to ordinary differential equations
34C08 Ordinary differential equations and connections with real algebraic geometry (fewnomials, desingularization, zeros of abelian integrals, etc.)
37E99 Low-dimensional dynamical systems

Keywords:

reaction network; toric system; Euclidean embedded graph

Full Text: DOI

References:
