Presenter:

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Title:

Persistence in Chemical Reaction Network Theory

Abstract:

Persistence is the asymptotic property of positive functions of time that do not approach zero, be it steadily or in a recurring fashion; in the parlance of dynamical systems, zero is not an omega-limit point. In applied contexts, the functions could represent sizes of populations of living species or concentrations of chemical or biochemical species. Persistence would then express the non-extinction of species. Persistence and the related notion of permanence have long been studied in population dynamics. In chemical reaction network theory, issues of persistence have always been implicitly present but explicit attention to the topic is relatively recent. Other than being of inherent interest, persistence has implications for the global asymptotic stability of positive equilibrium states.

In this talk, we will begin by explaining persistence in the context of chemical reaction networks and highlight some of the known results. We will then introduce vacuous persistence, a stronger form of persistence which we are proposing to account for the possible absence of some species at initial state, a common situation in biochemistry experiments. As time permits, we will discuss some results on vacuous persistence: 1) A necessary and sufficient condition for vacuous persistence that depends solely on network structure; 2) The fact that the absence of isomerism among elementary species assures vacuous persistence; and 3) The result that binary enzymatic networks under certain widely applicable conditions are vacuously persistent.