A Positive Real Eigenvalue Condition for the Determination of Unstable Steady States in Chemical Reaction Networks

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The interesting dynamical behaviours exhibiting in chemical reaction systems, such as multiple steady states and undamped oscillations, often result from unstable steady states. A positive real eigenvalue condition is proposed which gives a necessary and sufficient condition for the determination of an unstable steady state having a positive real eigenvalue in general isothermal reaction networks. Formulas are developed to construct an unstable steady state and a set of positive rate constants. The applications are illustrated by three examples. Two give rise to oscillations and one admits multiple steady states.