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Oscillations and the cycle structure of reaction networks

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Reaction network models are often represented as systems of parametric ordinary differential equations or directed graphs (digraphs). Oscillations are an ubiquitous phenomenon in reaction networks models, and they usually arise as a result of a Hopf bifurcation. A necessary condition for a Hopf bifurcation is zero determinant of the bialternate product matrix of the Jacobian. We present a corresponding graph-theoretic condition on the cycle structure of the digraph of reaction networks. (This is a preliminary report.)