Analysis of Enzyme-Catalyzed Reaction Model

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In this talk we discuss a substrate-activator system, which depends on a cubic polynomial with such a complicated relation between its coefficients and the original parameters that the coordinates of equilibria or even the number of equilibria can hardly be determined in many cases. All found results on its qualitative properties and bifurcations are given indirectly for the artificial parameter s_*, a coordinate of a general equilibrium, and the analysis of its dynamics remains far from completion. Not following the common idea of computing eigenvalues at equilibria, we give a complete analysis of equilibria directly for those original parameters by using continuity, monotonicity and some techniques of inequality. For a global analysis we discuss its equilibria at infinity, one of which possesses degeneracy so high sometimes that neither the well-known normal sector method nor the blowing-up method can be used easily. Furthermore, overcoming those difficulties from not solving all coordinates of equilibria, we give a versal unfolding with its original parameters to the degenerate cases and present bifurcation curves of periodic orbits and homoclinic orbits explicitly.