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Localized Spot Patterns for the Brusselator Reaction-Diffusion System

The Brusselator reaction-diffusion model characterizes dynamical processes of some reaction-diffusion systems in chemistry, physics, biology, and geology. On the sphere, the solutions of the Brusselator system center on a discrete set of points. In this talk, we study the system of differential-algebraic equations (DAEs) that describes the slow dynamics of localized spot patterns for the Brusselator model on the surface of a unit sphere. The DAE system is solved numerically using Matlab's ode15s function. The relationship between the equilibria of the DAE system and the set of elliptic Fekete points is studied. Precisely, solutions of the DAE system are obtained from solving the elliptic Fekete optimization problem. The optimization problem is solved using the particle swarm optimization method. It is verified that for N = 2, 3,. . . ,8 spots, the equilibrium spot configurations of the DAE system starting from a set of random initial points are elliptic Fekete points.