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Connecting Chaos in Two-Coupled Brusselators Model

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SUMMARY

The Brusselator model (I. Prigogine and R. Lefever, 1968) is a theoretical model that represents an autocatalytic chemical reaction with oscillations (Belousov-Zhabotinsky reaction). If we couple two identical Brusselators by diffusion, we obtain the system that concerns us: the two-coupled Brusselators model. This system has four variables (x_1, y_1, x_2, y_2) and four parameters (A, B, λ_1, λ_2) where λ_1 and λ_2 correspond to the coupling by diffusion.

This coupled system presents different dynamical regimes. For example, in the literature two different chaotic regions [1, 2] have been located in the parameter space. The first parametric region with chaotic behaviour [1] is much larger than the other one [2], which is associated with the existence of Shil'nikov homoclinic orbits. We define a new parameter α to join the biparametric plane (B, λ_1) of both regions. We study in detail the parameter phase space and how all the different elements are connected. In particular, we use several numerical and analytical techniques such as spike-counting sweeping, Lyapunov Exponents, continuation methods and Shil'nikov theory in order to study this coupled system [3].

Keywords: two-coupled Brusselators model, bifurcations, chaos, Shil'nikov theory

AMS Classification: 37Gxx, 37Mxx

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