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Multiple Bifurcation Analysis of Synchronized Cells with Delays

The synchronized cells in a neural network model with two discrete time delays is considered. The local stability of the zero solution of this system is investigated by studying the distributions of the eigenvalues of the system. Several groups of conditions have been given to guarantee the model having multiple synchronized periodic solutions when the transfer coefficient or time delay is sufficiently large. A complete bifurcation analysis is given by employing the center manifold theorem, normal form method and bifurcation theory. It is shown that the equilibrium point may lose stability via a transcritical/pitchfork bifurcation, Hopf bifurcation or Bogdanov–Takens bifurcation. Some numerical simulation examples are given to justify the theoretical results.