

Existence and Stability of Periodic Traveling Waves in a Bistable Excitable System

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Abstract : In this work, we proposed a modified FHN-type reaction-diffusion system for a bistable excitable system by adding a scaled function obtained from a given function. We study the existence and the stability of the periodic traveling waves (or wavetrains) for the FitzHugh-Nagumo (FHN) system and the modified one and compare the results. The stability results of the periodic traveling waves (PTWs) indicate that most of the solutions in the fast family of the PTWs are stable for the FitzHugh-Nagumo equations. The instability occurs only in the waves having smaller periods. However, the smaller period waves are always unstable. The fast family with sufficiently large periods is always stable in FHN model. We find that the oscillation of pulse widths is absent in the standard FHN model. That motivates us to study the PTWs in the proposed FHN-type reaction-diffusion system for the bistable excitable media. A good agreement is found between the solutions of the traveling wave ODEs and the corresponding whole PDE simulation.

Keywords : bistable system, Eckhaus bifurcation, excitable media, FitzHugh-Nagumo model, periodic traveling waves

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