Karlsruhe Institute of Technology

Seminar of the Work Group
Nonlinear Partial Differential Equations
SS 24

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Seminar room: SR 3.069

Pattern Selection via Marginal Stability of Pushed Fronts in the FitzHugh-Nagumo System

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Abstract

Complex coherent structures in physical systems often form after a homogeneous background state becomes unstable. When the transition out of the unstable state is seeded by a spatially localized perturbation, this perturbation grows and forms an invasion front, which propagates into the unstable state and selects a new state in its wake. The marginal stability conjecture asserts that the propagation speed is the unique speed for which the associated invasion front solution is marginally spectrally stable. In many cases, propagation at a fixed speed combines with oscillatory dynamics in either the leading edge or the wake of the invasion process to generate a spatially periodic pattern. Universal wavenumber selection laws predict the wavelength of this pattern through an appropriate combination of the selected speed and the frequency of the temporal oscillations. We explore this phenomenon in the FitzHugh-Nagumo system, a prototypical model for large amplitude pattern formation. In this setting, we give the first rigorous proof of the marginal stability conjecture and associated wavenumber selection laws for any pattern-forming invasion process. This is joint work with Paul Carter and Björn de Rijk.