The Hong Kong Polytechnic University
Department of Applied Mathematics

Colloquium

Evans Functions and Bifurcations of Standing Wave Fronts of A Nonlinear System of Reaction Diffusion Equations

by

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Abstract

Consider the following nonlinear system of reaction diffusion equations arising from math-ematical neuroscience

$$\begin{aligned} \frac{\partial u}{\partial t} &= \frac{\partial^2 u}{\partial x^2} + \alpha[\beta H(u-\theta) - u] - w, \\ \frac{\partial w}{\partial t} &= \varepsilon(u - \gamma w). \end{aligned}$$

Also consider the nonlinear scalar reaction diffusion equation

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2} + \alpha[\beta H(u-\theta) - u].$$

In these model equations, $\alpha > 0$, $\beta > 0$, $\gamma > 0$, $\varepsilon > 0$ and $\theta > 0$ are positive constants, such that $0 < 2\theta < \beta$. In the model equations, $u = u(x, t)$ represents the membrane potential of a neuron at position x and time t, $w = w(x, t)$ represents the leaking current, a slow process that controls the excitation.

The main purpose of this paper is to couple together linearized stability criterion (the equivalence of the nonlinear stability, the linear stability and the spectral stability of the standing wave fronts) and Evans functions (complex analytic functions) to establish the exis-tence, stability, instability and bifurcations of standing wave fronts of the nonlinear system of reaction diffusion equations and to establish the existence and stability of the standing wave fronts of the nonlinear scalar reaction diffusion equation.

I will also talk about the relationship between the stability of the traveling wave front of the nonlinear scalar reaction diffusion equation and the stability of the fast multiple traveling pulse solutions of the system.

Date : 28 December, 2015 (Monday)
Time : 10:30a.m. – 11:30a.m.
Venue : TU801, The Hong Kong Polytechnic University

*** * * ALL ARE WELCOME * * ***