Effective Boundary Conditions of Diffusion Equations on Domains Containing Thin Layers

SPEAKER: Xuefeng Wang, Southern University of Science and Technology

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VENUE: Room 264, Geography Building, Zhongbei Campus, ECNU

HOST: Xingbin Pan, East China Normal University

ABSTRACT

This is going to be survey talk on a class of diffusion equations. Of concern is the following scenario: a domain consists of two parts, with one of them being a thin layer; on the domain we have a diffusion equation, one of whose physical parameters such as diffusion coefficient has different size scales on different subdomains. This kind of problem arises in real applications such as thermal barrier coatings of turbine engine blades, and effects of roads on the spreading of populations and epidemics. Numerical computation of such a diffusion equation on such a domain is time-consuming because we would need very fine grids on the thin layer; moreover, we cannot see easily the effects of the thin layer on the dynamics of the diffusion equation. A good way to resolve this problem is to think of the thin layer as a thickless surface/curve, on which we impose an effective boundary condition (EBC); then hopefully with ease we can solve, numerically, the diffusion equation on the remaining subdomain with the EBC; furthermore, we can see the effects of the thin layer via EBC. We will review classic theorems, and introduce results obtained in recent years, as well as results that have not been published. These results not only are of practical significance, but also bring some new challenges to pure PDE research.

BIOGRAPHY

Professor Xuefeng Wang joined Southern University of Science and Technology at Shenzhen in early 2016; prior to that, he worked at Tulane University for 25 years. His early work (on semilinear heat equations in the whole space, on concentration of ground states of nonlinear Schrödinger equations, and on traveling waves in nonlocal diffusion equations) triggered a large body of work by other researchers. His current research interests include effective boundary conditions of diffusion equations on domains with thin layers, global bifurcation theory applied to elliptic systems, and eigenvalue problems (local and nonlocal).