Global Dynamics of Some Reaction and Diffusion Population Models in Heterogeneous Environments

Mr. Xiao Yu
PhD Candidate

Supervisor: Dr. Xiaoqiang Zhao

Department of Mathematics and Statistics, Memorial University

Thursday, October 22, 2015
HH 3017
1:00-2:00 pm

Abstract

In spatial ecology and population biology, reaction and diffusion models are widely used to capture the spatial and temporal dynamics of species and to better understand biological invasions. It is well known that seasonal change and geographic variations in temperature, rainfall and resource availability have crucial effects on the survival and reproduction of populations. This thesis is devoted to the study of the global dynamics of some reaction and diffusion models incorporating with spatial and/or temporal heterogeneities. To be specific, we first investigate the spatial dynamics of a reaction-advection-diffusion model for a stream population in a time-periodic environment. Then we explore the propagation phenomena for a Lotka-Volterra reaction-advection-diffusion competition model in a periodic habitat. Moreover, we establish the theory of traveling waves and spreading speeds for time-space periodic monotone semiflows with monostable structure and apply it to a time-space version of the two-species competition model. To understand the effects of the spatial heterogeneity on the spread of Lyme disease, we propose a nonlocal and time-delayed reaction-diffusion model and obtain the global stability in terms of the basic reproduction ratio and the spreading speed of the disease. At the end of thesis, I also present some interesting problems for further investigation.