Reaction-Diffusion Equations Arising in the Mathematical Modelling of Population Dynamics

Lecturers

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Synopsis

During the last eighty years, reaction-diffusion equations have been extensively used to achieve a better understanding of a wide range of ecological phenomena. The goal of this mini course is to provide a gentle introduction to reaction-diffusion equations arising in the mathematical modelling of population dynamics. In particular, the cases of space-structured populations and phenotype-structured populations will be considered. The main qualitative properties of the solutions to these equations will be studied and examples of possible real world applications will be discussed. The course will be organised into two related parts as follows:

Part 1. Reaction-diffusion equations for space-structured populations

    1.1 Local reaction-diffusion equations modelling space dispersal

    1.2 Local reaction-diffusion equations modelling spatial dynamics of invasion

    1.3 Local reaction-diffusion equations modelling competitive interactions

Part 2. Phenotype-structured models for tumour growth

    2.1 Simple models for tumour growth

    2.2 Mathematical models for natural selection

    2.3 Mathematical models for mutation-selection dynamics

Recommended Books

J.D. Murray
Mathematical Biology I: An Introduction
Springer, 3rd ed. 2003

J.D. Murray
Mathematical Biology II: Spatial Models and Biomedical Applications
Springer, 3rd ed. 2003

B. Perthame
Transport Equations in Biology
Birkhäuser, 2007

B. Perthame
Parabolic Equations in Biology - Growth, Reaction, Movement and Diffusion
Springer, 2015