International Workshop on Differential Equations in Mathematical Biology

Structured Models for Disease Spreads

Jianhong Wu

Department of Mathematics and Statistics
York University
Toronto, Ontario, Canada M3J 1P3
wujh@mathstat.yorku.ca

ABSTRACT

We revisit the spatial spreads of rabies in continental Europe during the period roughly between 1945-1985. We show how the distinction of territorial patterns between juvenile and adult foxes, the main carriers of the rabies under consideration, yields a new class of partial differential equations involving delayed and non-local terms that are implicitly defined by a hyperbolic-parabolic equation, and we sow how incorporating this distinction into the model leads to some improvement of the calculation of the minimal wave speeds.

We show how the homotopy argument developed by Chow, Lin and Mallet-Paret can be applied to obtain the existence of a heteroclinic orbit between a disease free equilibrium and an endemic state for the spatially averaged system of delay differential equations, and we illustrate how the technique developed by Faria, Huang and Wu can be used to establish the existence of a family of traveling wavefronts in the neighborhood of the heteroclinic orbit for the corresponding spatial model.

We shall discuss possible applications of the modeling and analysis techniques to the study of the spatio-temporal patterns of the West Nile virus.

Key Words: Spatial spread, diseases, traveling waves, heteroclinic orbits, delay, non-local problem, structured population models, rabies, West Nile virus.