

MATHEMATICS DEPARTMENT
North Carolina State University

DIFFERENTIAL EQUATIONS SEMINAR

Wednesday, April 23, 2003
2:35 p.m. 330 Harrelson Hall

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Duke University

“Dynamics of a two-dimensional continuum model for swarming”

A biological swarm is a group of organisms undergoing large-scale coordinated movement. Typically, this movement is not due to centralized control, but rather to social interactions which occur on a length scale smaller than that of the global swarm formation. Swarms occur in populations of ants, locusts, fish, birds, wolves, and others, and are often observed to have sharp boundaries and a roughly spatially-constant population density. In this talk, I will discuss preliminary results for a simple continuum model for swarming in two dimensions. The population density ρ satisfies an advection equation. The velocity depends nonlocally on ρ by means of a convolution with a spatially decaying kernel K , which describes the social interaction between organisms. Using the Hodge decomposition theorem, the velocity field may be decomposed into a divergence-free component and a gradient component. This framework provides a convenient way to characterize the two-dimensional dynamics. The gradient component controls the expansion or contraction of the population, while the divergence-free component is responsible for its rotational motion. Numerical simulations of the model reveal vortex states similar to those observed in nature.

Graduate students are invited to attend.

For questions, comments, and offers to talk, contact Steve Schecter, schecter@math.ncsu.edu.

Please visit the DE Seminar web page at www.math.ncsu.edu/seminars.html.