Lecture series at the New Zealand Institute for Advanced Study,
Massey University

MATHEMATICAL MODELING OF NONLINEAR PHENOMENA

Visiting Professor Tassos Bountis
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A series of lectures will be given at the New Zealand Institute for Advanced Study, **a**s follows:
Target audience: NZIAS/INMS phd students, postdocs, interested faculty
Times: 14:00 – 15:00
Dates, location and corresponding titles:

1) Tue March 19 (OR2): The Mathematics of Complexity: Chaos and Fractals
2) Wed March 20 (OR9): Cluster Formation in Granular Dynamics and Traffic Flow
3) Tue March 26 (OR2): Synchronization and Wave Phenomena in Biological Models
4) Wed March 27 (OR9): Fundamental Concepts of Hamiltonian Dynamical Systems
5) Wed April 3 (OR9): Local and Global Stability in Hamiltonian Dynamics
6) Tue April 9 (TBA): Statistical Mechanics of Chaotic Hamiltonian Systems

These lectures are meant to be introductory, with the main ideas presented in a pedagogical way by means of simple examples. They are aimed primarily at graduate students interested in complex phenomena occurring in various disciplines. In the first 3 lectures, we will be concerned with the emergence of collective behavior in the form of clustering, flocking, synchronization, etc. as they occur in dissipative systems. Our approach will be to start from some crucial observation or experiment and seek to construct the appropriate mathematical model that captures the main features of the data. The remaining 3 lectures will focus on a class of "conservative" systems described by N-degree of freedom Hamiltonian functions, which are familiar to us from classical mechanics, astronomy and solid state physics. Our main point will be to show that despite a well established general theory, there are still many important local phenomena involving various degrees of order and chaos, which can have global consequences, regarding the physical properties of these systems, especially for long times and large N.

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