LTCC Proposed Course

- Title: Nonlinear Waves and Solitons
- Basic Details:

  Core Audience: 2nd/3rd year: applied

  Course Format: intensive (8 hours)

- Course Description:

  Keywords: Nonlinear waves, Solitons, Inverse scatteing method, Korteweg-de Vries equation

  Syllabus:

  In this course, students will be introduced to nonlinear phenomena and be shown how Mathematics can provide a qualitative description of these phenomena which are observed in the real world and a discussion of some recent developments including an indication of some current applications of research in this field. The material is chosen so as to demonstrate the range of Mathematical techniques available and to illustrate the many different applications which are modelled by nonlinear partial differential equations. A wide range of Mathematical tools and ideas are drawn together in the investigation of the properties of the associated nonlinear partial differential equations.

  Review of the linear wave equation and the method of Fourier transforms for solving linear equations. Elementary travelling wave and scaling solutions of partial differential equations. Origin and physical applications of nonlinear partial differential equations; shallow water wave theory and the derivation of the Korteweg-de Vries equation.

  Historical remarks and the discovery of the soliton. Travelling wave solutions for the Korteweg-de Vries equation. Inverse scattering for the Korteweg-de Vries equation. Soliton and rational solutions. Conservation laws. Bäcklund transformations and nonlinear superposition principles. Hirota's method, with applications to the Korteweg-de Vries and related equations.

  Recommended reading:

  M J Ablowitz & P A Clarkson, "*Introduction to Nonlinear Waves, Solitons and Symmetries*", *Texts in Applied Mathematics*, CUP, in preparation

  Additional Optional reading:

  M J Ablowitz & P A Clarkson, "*Solitons, Nonlinear Evolution Equations and Inverse Scattering*", *L.M.S. Lecture Note Series*, vol. **149**, C.U.P. (1991)

  P G Drazin & R S Johnson, "*Solitons: an Introduction*", *Texts in Applied Mathematics*, CUP (1989).

  Prerequisites:

- Format:

  No of discussion/problem sheets: 1

  Electronic lecture notes: These will be provided

  Necessary support facilities: None

  Necessary software requirements for computing facilities:

  Proposed timing: May/June

  Lecture/computer session/tutorial/discussion split (hours of each): 8 h of lectures

- Lecturer Details:

  Lecturer: Professor Peter A Clarkson

  Lecturer home institution: University of Kent

  Lecturer e-mail: P.A.Clarkson@kent.ac.uk

  Lecturer telephone number: 01227 827781