

LTCC Proposed Course

- Title: Differential equations with delay and applications to mathematical biology.
- Basic Details:
 - Core Audience: advanced (2nd/3rd year), applied/pure mathematics.
 - Course Format: extended (10 hours at 2 hours per week).
- Course Description: differential equations with delay mechanisms are of current interest. In particular, such mechanisms are well suited for modeling biological phenomena. The course aims to explain the main basic ideas, theories and techniques used to apprehend such problems. We shall also visit significant examples illustrating the main difference with non delay systems, in particular with the weekly problem sheets.
 - Keywords: differential equations, delay, periodic solutions, attractors, Lotka-Volterra systems.
 - Syllabus:
 1. Examples, types of delays, classification, linear systems with delay, characteristic equations.
 2. Abstract dynamics, semi-flows, stability, periodic solutions, chaotic behaviour.
 3. Global dynamics of single species equations, Hopf bifurcation and periodic solutions.
 4. Lotka-Volterra systems with delays, comparison with ODEs.
 5. Further topics and open problems selected from PDEs with delays, numerics, multiple delays or symmetric dynamical systems.
 - Recommended reading:

Y. Kuang, *Delay differential equations with applications in population dynamics*, Mathematics in Science and Engineering 191, Academic Press Inc., Boston MA (1993).

H. Smith, *An Introduction to Delay Differential Equations with Sciences Applications to the Life*, Text in Applied Mathematics 57, Springer Verlag, New York (2010).
 - Additional optional reading (additional references, research papers, will be suggested during the course):

T. Erneux, *Applied delay differential equations*, Surveys and Tutorials in the Applied Mathematical Sciences 3, Springer-Verlag, New York (2009).

O. Diekmann, S.A. van Gils, S.M. Verduyn Lunel, H-O. Walther, *Delay equations, Functional, complex, and nonlinear analysis*, Applied Mathematical Sciences 110, Springer-Verlag, New York (1995).
 - Prerequisites: an understanding of the qualitative theory of ODEs will be an advantage (background notes and references will be provided as required).
- Format:
 - Lecture notes in electronic format are being revised and will be provided.
 - Five example/problem sheets.
 - Necessary support facilities: lecture room with projector.
 - Necessary software requirements for computing facilities: projecting pdf files.
 - Proposed timing: January-February 2013.
- Lecturer Details:
 - Lecturer: Dr. Jacques-Élie Furter.
 - Lecturer home institution: Brunel University.
 - Lecturer e-mail: mastjef@brunel.ac.uk.
 - Lecturer telephone number: (01895) 265183.