Advanced Mathematical Perspectives II

Deterministic Models Module:
Fourier Transforms and Applications

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Semester 2, 2018

Times:

Weeks 7 to 9 (September 3 to October 5)
MWF 10.10—11.00 (EM G06) and Tu 2.10–3.00 (EM G07)
Workshop-style classes everyday
(some class times will be announced as consultation hours)

Contact Details:

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Attendance:

Since the classes will be conducted in workshop style, *attendance is mandatory* (except for classes designated as consultation hours).

Resources:

The course resources for this module will include guided worksheets (that you will work on in class, sometimes in collaboration with your classmates), notes that *you* take based on material that the instructor occasionally covers on the board, handouts (handed out in class), and provided `Matlab` codes.

You may of course use any other resources. A principal resource—made doubly available to you via the workshop-style class structure—is your instructor. Asking questions, and asking for help, is *expected*!

Course Assessments:

There will be two graded assignments, which will include project-style components. These are to be handed in in *hardcopy* to your instructor. The two assignments will contribute equally to your final grade for the Deterministic Models Module of AMP II.

Assignment 1: Due by end of class on Friday, 14 September (Week 8).
Assignment 2: Due by 11 am on Friday, 12 October (Week 10).

Matlab:

You are expected to have access to `Matlab`. Information on how you can use it via the University's license is available at ADAPT. To ensure full functionality, run `Matlab` on a computer, not on a tablet or phone.

Basic Philosophy

This module—specifically limited to students in the Advanced Mathematics stream—is structured to attain goals which are elusive in a more traditional format. We will emphasise ***student-centred learning***, ***active participation***, ***discovery-based learning***, ***critical thinking***, ***development of research skills***, ***taking responsibility for one's own learning***, ***development of both analytical and computational skills***, ***exposure to mathematical modelling***, and ***extending mathematics beyond traditional boundaries***.

Course Content and Tentative Timetable

General context

This module covers ***Fourier Transforms and Applications***.

Week 7

- Euler formula
- Inner product
- Orthogonality for piecewise-continuous functions on $[0, T]$
- Complex Fourier series
- Fourier transform definition

Week 8

- Fourier transform properties
- Dirac delta 'function' and distributions
- Convolution

Week 9

- Numerically obtaining Fourier transforms: `fft`
- Signal processing: smoothening signals
- Fourier transform method for PDEs in infinite domains