MA999-15 Topics in Mathematical Modelling

23/24

Department
Warwick Mathematics Institute
Level
Taught Postgraduate Level
Module leader
Yulia Timofeeva
Credit value
15
Module duration
10 weeks
Assessment
100% coursework
Study location
University of Warwick main campus, Coventry

Description

Introductory description

N/A.

Module web page

Module aims

This is a core module for the Mathematics for Real-World Systems II CDT renewal. The aim is to introduce students to cutting-edge topics in mathematical modelling that cover the application areas of the CDT: biomedical science, epidemiology, socio-technical systems, and industrial processes and optimization. The topics covered will be used as examples to illustrate fundamental modelling approaches, in particular multiscale modelling and hybrid modelling, which bridges the divide between a priori and data-driven methods .

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

The module will provide practical examples of the two research themes of the MathSys II CDT: (1) Multiscale Modelling and (2) Hybrid Modelling. These will be demonstrated using practical examples taken from the application areas of the CDT: quantitative biomedical research, mathematical epidemiology, socio-technical systems and advanced modelling and optimisation of industrial processes. Students will learn how to relate and apply the skills learned in the first-term core modules and understand how the various theoretical methodologies can be used to solve real-world problems. The concepts utilised will include: symmetries and constraints, phase transitions, stochastic and deterministic modelling, data-driven modelling, agent-based modelling, course graining, non-linearities and bifurcations and probability.

Learning outcomes

By the end of the module, students should be able to:

- The students will learn how to use the knowledge and techniques they have acquired in the other core modules of the MSc programme to tackle particular mathematical challenges which are related to real world problems of partners of the CDT.
- Apply mathematical modelling techniques taught in the core of the course to cutting-edge research questions.
- Get an overview over a research area and give a critical summary and list of interesting problems.
- Understand and present a recent research paper in the context of the mathematical background of the MSc cohort.
- Should be acquainted with 4 current research areas within the CDT which will guide them in choosing MSc and PhD projects.

Indicative reading list

Recent research papers in the field of the 4 lecturers. Will be made available well in advance when the module is advertised to the students.

Subject specific skills

See learning outcomes.

Transferable skills

Students will acquire key reasoning and problem solving skills which will empower them to address new problems with confidence.

Study

Study time

Type	Required
Lectures	10 sessions of 3 hours (20%)
Tutorials	10 sessions of 1 hour (7%)
Private study	110 hours (73%)
Total	150 hours

Private study description

Self-study.

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Assessment group A2

	Weighting	Study time
Assessed Coursework	100%	

Feedback on assessment

Coursework will receive written feedback. Additional oral feedback available from lecturer and TA during problem classes.

Availability

Courses

This module is Core for:

- RMAA-G1PG Postgraduate Research Mathematics of Systems
  - Year 1 of G1PG Mathematics of Systems
  - Year 1 of G1PG Mathematics of Systems
- TMAA-G1PF Postgraduate Taught Mathematics of Systems
  - Year 1 of G1PF Mathematics of Systems
  - Year 1 of G1PF Mathematics of Systems

This module is Optional for:

- Year 2 of TPXA-F345 Postgraduate Taught Modelling of Heterogeneous Systems (PGDip)
- Year 1 of TESA-H1B1 Postgraduate Taught Predictive Modelling and Scientific Computing

This module is Option list B for:

- Year 1 of TPXA-F345 Postgraduate Taught Modelling of Heterogeneous Systems (PGDip)