Engineering Tripos Part IIB, 4G4: Biomimetics, 2022-23

Module Leader

Prof F Iida [1]

Lecturers

Dr F Iida, Dr W Federle [2]

Timing and Structure

Lent term. 14 lectures (Week 1-7) + 2 lecture slots for group project presentations (Week 8). Assessment: 100% coursework

Aims

The aims of the course are to:

- Engineering means to adopt and adapt ideas from nature and make new engineering entities.
- Interdisciplinary communication between engineers and biologists
- Plan and conduct of biomimetic research projects
- Professional presentation of research proposals and reports

Objectives

As specific objectives, by the end of the course students should be able to:

- Examples of biomimetics research from lectures
- Effective means to conduct literature search
- How to select and structure innovative research projects
- How to conduct a biomimetics project in groups
- Practicing professional presentations

Content

This module aims to introduce methods of conducting interdisciplinjary research of biomimetics. We provide lectures about various biomimetics projects, and the studens will apply knowledge and techniques to their own group projects.

Introduction and Project assignment (F Iida, W Fiderle, CUED) (2L)

- Introduction of the module;
- Introduction of biomimetics research (concepts and methods)
- Methods of writing research proposals and reports

Bioinspired legged locomotion (F. Iida, CUED) (2L)

- Foundation of biological locomotion
- Models of legged locomotion

- Analysis, experiments, and applications

Biomimetic adhesion and adhesives (W. Federle, Zoology) (4L)

- Foundation of biological adhesion
- Models of biological adhesion
- Analysis, experiments and application

Animal Group Behaviours and Artificial LIfe (J Herbert-Read and F Iida) (2L)

- Animal group as mobile sensor networks
- Collective/swarm behaviours
- Cellular automata and game of life

Biomimetic flight dynamics (H. Babinsky, CUED, 2L)

- Foundation of biological flight locomotion
- Models of flapping flight
- Analysis, experiments and applications

Artificial Life (F. Iida, CUED, 2L)

- Introduction to artificial life
- Models and methods of artificial life research
- Reaction defusion models
- Cellular automata
- Evolutionary algorithms

Project Presentations (2L)

Coursework

Coursework	Format	Due date & marks
Coursework activity #1: Written report 1 (30%): Group project proposal. Maximum 10 pages. Assessment criteria are the detailed descriptions about problem statement, literature review, hypotheses (model), and methods.	Group report Marked by group	
Coursework activity #2: Group presentation (20%): Oral presentations of group projects in Week 8. 10-minute presentation + 5 minute discussion. Assessment criteria are structure, clarity, completeness of the presentations as well as handling of questions and discussions.	Group presentation Marked by group	
Coursework activity #2: Written report 2 (50%): Individual report of group projects. Maximum 10 pages. Assessment criteria are: quality of abstract, introduction, methods, results, discussions and conclusions.	Individual report Anonymously marked	

Each project group will attend 2 group supervision sessions (compulsory, time-tabled for one hour each in Week 3 and 6), supervised by F Iida and W Federle (2-6 sessions each depending on the number of students). In these supervisions, project groups should report and discuss the contents of the project proposal (Week3), and that of the final presentations and reports (Week6). One demonstrator will also be available in Week 6-8, who assists further group projects.

Booklists

Please refer to the Booklist for Part IIB Courses for references to this module, this can be found on the associated Moodle course.

Examination Guidelines

Please refer to Form & conduct of the examinations [3].

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Links
[1] mailto:fi224@cam.ac.uk
[2] mailto:fi224@cam.ac.uk, wf222@cam.ac.uk
[3] https://teaching23-24.eng.cam.ac.uk/content/form-conduct-examinations