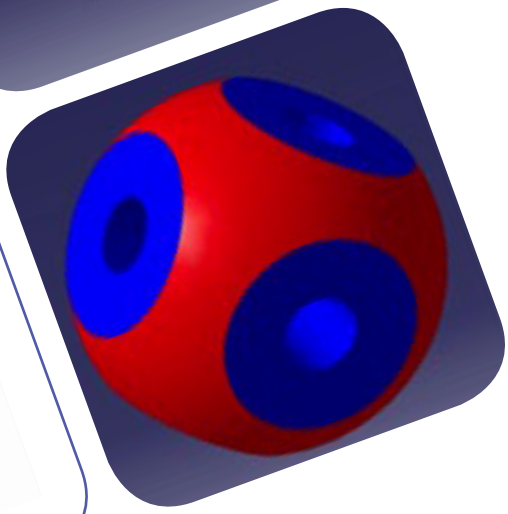
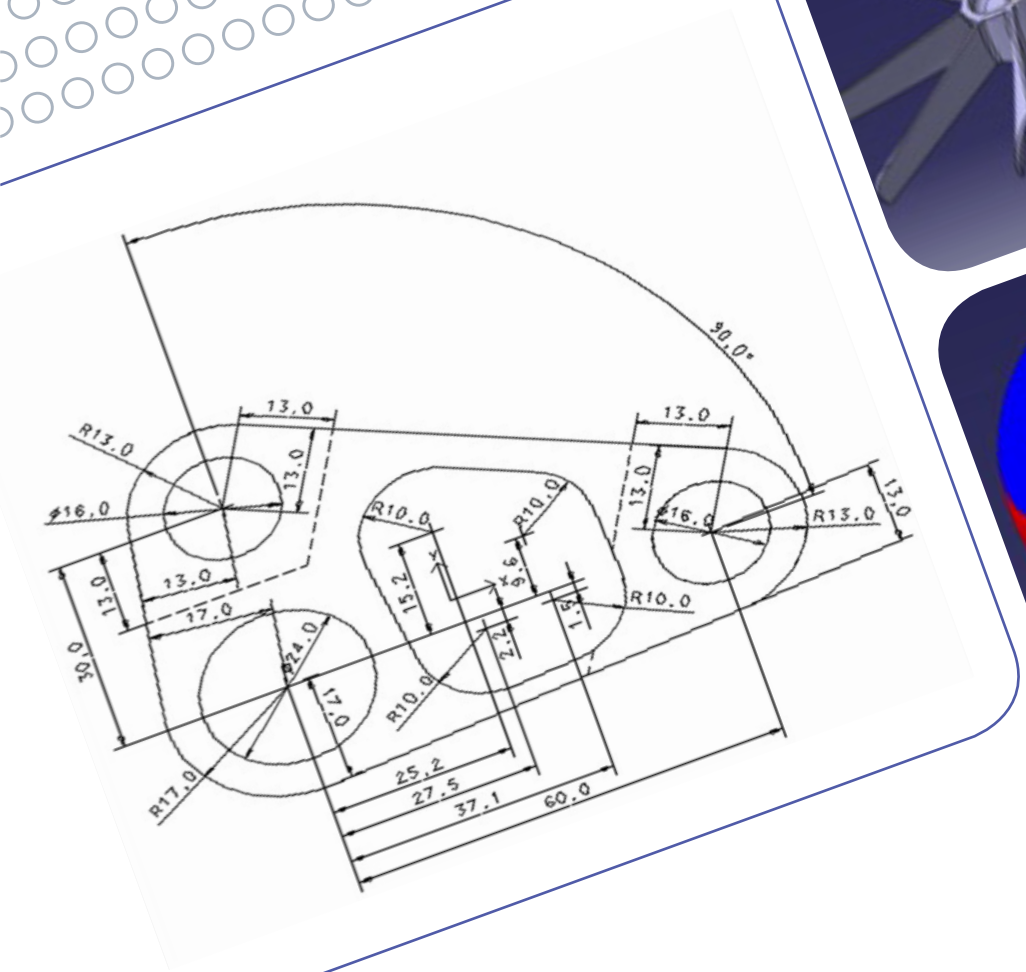
School of Engineering

Cranfield UNIVERSITY

MSc in Computational and Software Techniques in Engineering

Option in Computer Aided Engineering





www.cranfield.ac.uk/soe/cae

MSc in Computational and Software Techniques in Engineering, option in **Computer Aided Engineering**

Computer Aided Engineering covers the use of computers in all activities from the design to the manufacture of a product. It is at the forefront of information technology and of crucial importance to economies around the world. It is a vital part of many global industries including those of automotive, aerospace, oil, defence and health. Computer Aided Engineering systems provide virtual product development environments allowing 3D models to be created, analysed, optimised and stored efficiently; operational and extreme physical conditions can be evaluated, reducing (and sometimes eliminating) the need for prototypes.

The MSc in Computational and Software Techniques in Engineering has been developed to reflect the wide application of CAE and to deliver qualified engineers of the highest standard in to industries operating in the fields of computational and software engineering.

The course is suitable for candidates from a broad range of engineering backgrounds, including aeronautic, automotive, mechanical and electrical engineering, in addition to those with a mathematical and computational sciences training, who wish to both develop and complement their existing skill-set in these important areas.

Stand out from the crowd

The MSc benefits from the knowledge and experience gained by the staff through their strong industrial links, particularly our well-established research collaborations with the petrochemical, automotive, aeronautical and financial sectors. Students interact with industry experts and partners through seminars, the research programme and industrially supported thesis projects.

The course will equip students with analytical, organisational and interpersonal skills so that they can practically apply the knowledge gained to real engineering problems.

Focus on your interests

The CAE option within the MSc for Computational and Software Techniques in Engineering comprises of 4 core skill modules, 6 specialist modules, a group design project and an individual thesis.

The individual thesis provides the opportunity for students to deepen their knowledge of an area that is of particular interest to them and is often associated with a real world problem that one of our industry partners are looking to resolve.

Unique facilities

Students have access to state-of-the art CAE tools, including CAD software, finite element analysis and computational engineering packages. Significant exposure to these modern, state-of-the art tools and associated techniques enables students to exploit this technology to maximum benefit. Cranfield students also have access to a range of outstanding research facilities. These include the super-computer facilities which are available via the Cranfield High Performance Computing facility.

Learning environment

Cranfield University is a wholly postgraduate institution which offers a mature and focused learning environment. This makes Cranfield uniquely structured to maximise its alliances with industry, ensuring our students benefit from being involved in extensive delivery of applied research. It has an international student body and reputation offering a rich learning environment for a potentially global career path.

Research and Careers

Research at Cranfield University

The Applied Mathematics and Computing Group specialises in the application of mathematical and computational techniques to engineering problems - including the aeronautics, petrochemical, CAE and financial sectors.

Current industrial and research projects and collaborations include advanced modelling of pipeline systems (including flow stability, vibration and protection) design optimisation, software systems for the financial sector and developments in CAD systems.

MSc Group Design Project

The group project is designed to give students invaluable experience of delivering a project within an industry structured team. The project allows students to develop a range of skills including learning how to establish team member roles and responsibilities, project management, delivering technical presentations and gaining experience of working in teams that include members with a variety of expertise and often with members who are based remotely.

Part-time students are encouraged to participate in a group project as it provides a wealth of learning opportunities. However, an option of an individual dissertation is available if agreed with the course director.

MSc Research Thesis Project

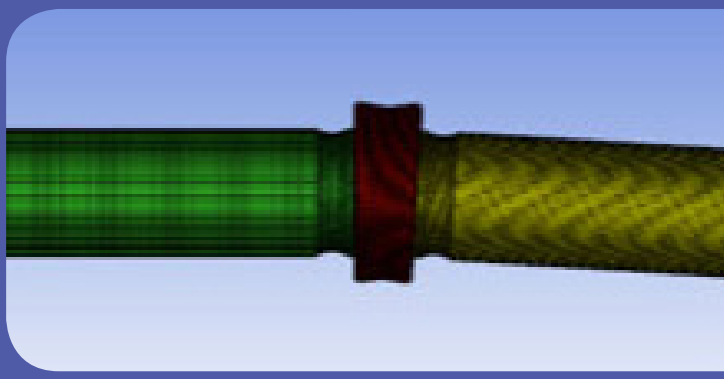
The individual research thesis allows students to delve deeper into an area of specific interest. It is very common for industrial partners to put forward real world problems or areas of development as potential research thesis topics. For part-time students it is common that their research thesis is undertaken in collaboration with their place of work.

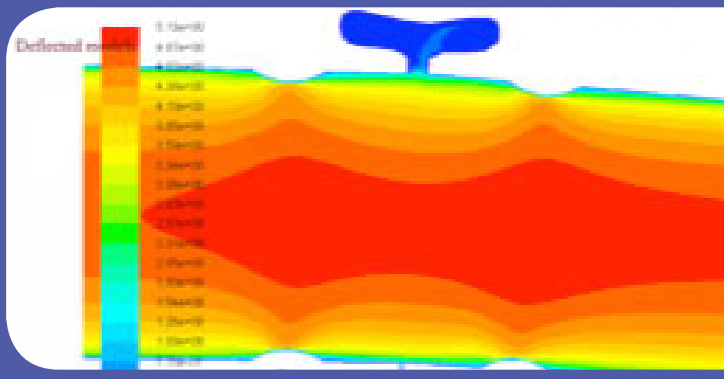
Recent thesis topics have included:

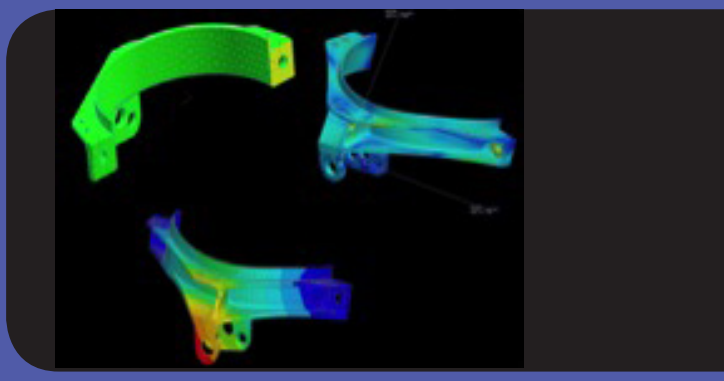
- Analysis of aircraft control surface
- Comparative analysis of parallel performance and scalability of incompressible CFD solvers
- Automated workflow for a car roof-box optimisation
- Design optimisation of helical gear pair in helicopter transmission systems
- Design and analysis of an adjustable rear view car spoiler
- Surfboard modelling using CFD
- Displacement mapping using splines.

Careers

Graduates in this option have open to them a wide range of careers embracing the automotive and aeronautical industries, engineering software houses and industrial research where demand for skills is high.







Course information

The MSc in Computational and Software Engineering is delivered via a combination of structured lectures, tutorial sessions, computer based workshops and private study. Knowledge and understanding are further enhanced by seminars that are delivered by invited industrial or academic experts.

Our Computer Aided Engineering (CAE) option is aimed at students interested in software development within the wide spectrum of industries in which CAD modelling, simulation and analysis play a significant role. The course consists of specialist taught modules, a group project and an individual research project.

A combination of mathematical, computational and hands-on use of industry standard CAE systems form the basis of the specialist modules, covering the theory and application of CAE based software for the modelling, analysis and simulation, in diverse fields such as automotive, aeronautical, flow related industries, data fitting and visualisation. This set of specialist modules are designed to provide students with the knowledge, programming techniques and practical skills necessary to develop and use core CAE solution software over a wide range of industrial settings.

Core Skills Modules

Object Orientated Programming and Design
Object oriented programming (OOP) is the standard programming methodology used in nearly all fields of major software construction today.

Computer Graphics
Hands-on introduction to the programming paradigms, techniques and libraries used in the construction of graphical user interfaces and an overview of the mathematical principles behind 2D and 3D visualisation, the viewing pipeline and their practical implementation in the widely used Open-GL graphics library.

Computational Methods
The importance of linear systems in engineering situations and a variety of computational methods for solving linear systems of equations and eigenvalue problems.

Management for Technology
An engineer must also acquire management training. An intensive two-week short course run by the Cranfield School of Management aims to equip students with the management learning tools required in a modern industrial environment.

Specialist Knowledge Modules

Advanced Graphics
Introduction to the advanced techniques used in the generation of computer graphics including how to generate more realistic effects, such as the use of lighting and surface details to create realistic representations of computer generated graphical objects and display them to the screen.

CAE Applications (I and II)
The focus here is on the key concepts, techniques and applications of a 3D solid modelling system. The second part of this double module includes: applications of structural analysis and some Product Life-cycle Management (PLM).
Structured computer-based workshops are used employing an industry standard system for 3D Solid Modelling.

Geometric Modelling
The fundamental algorithms, techniques and software used for the construction of parametric curves, surfaces and solids are covered here. The techniques form the basis of free-form modelling as used in CAD/CAM systems, visualisation and computer graphics.

Advanced Engineering Applications
Numerical solutions of partial differential equations are used for simulating physical systems and phenomena and for the investigation of a wide range of engineering applications. We focus on the mathematical background to the discretisation of these equations using finite element and finite difference approaches.

Computational Engineering (fluids)
We introduce students to the techniques and tools for modelling, simulating and analysing realistic computational engineering problems for commercial software packages used in industry.

Computational Engineering Design Optimisation
Students are introduced to techniques for modelling, simulating and analysing realistic computational engineering problems in the context of design optimisation. The engineering design optimisation method is introduced along with numerical methods used in optimisation.

Key facts

Entry requirements
Applicants are required to either have a minimum of a UK 2nd class honours degree or its equivalent in aeronautical, mechanical or electrical engineering or computer science or be applying as part of a recognised double-degree programme with their home EU institution.

Applications from candidates with lesser qualifications but with considerable relevant work experience will be considered.

Number of places
25

Duration
Full Time: 1 year commencing annually in September.
Part Time: Nominally 2-3 years (flexible commencement date).

Contact

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www.cranfield.ac.uk/soe/cae

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