Welcome
Applied Computational Science & Engineering MSc
Open Day, Imperial College London
Modules and Learning Outcomes for Applied Computational Science and Engineering MSc
ACS-1: Modern programming methods
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On successful completion of this module, students will be able to:
1. Produce and validate software for sustainable and reproducible research.
2. Carry out test-driven software development and continuous integration.
3. Produce software collaboratively.
4. Create software using the Python programming language.
ACS-2: Modelling dynamical processes
On successful completion of this module, students will be able to:
1. Describe the mathematics underpinning continuum mechanics.
2. Derive the fundamental governing equations of continuum mechanics.
3. Relate the continuum descriptions of deformation and stress to the fundamental governing equations of continuum mechanics.
4. Consider the application of appropriate governing equations of continuum mechanics to applications in:
   a. fluid flow;
   b. heat transfer;
   c. electromagnetism;
   d. deformation of solids at different rates: viscoelastic, plastic and shocks
On successful completion of this module, students will be able to:
1. Describe and implement numerical methods to solve typical (algebraic/differential, linear/non-linear) equations, including Ordinary Differential Equations (ODEs), Partial Differential Equations (PDEs) and linear/non-linear equation solvers.
2. Contrast the fundamental properties of different numerical algorithms: stability, accuracy, consistency, convergence, and boundedness.
3. Critique the key numerical approaches for the solution of problems from continuum mechanics.
4. Apply knowledge of spatial and temporal discretisation methods and their properties.
ACS-4: Applying computational science
ACS-4: Applying Computational Science

On successful completion of this module, students will be able to:
1. Plan and produce software collaboratively.
2. Collaboratively write technical reports.
3. Summarise technical reports through collaborative presentations.
ACS-5: Advanced programming
On successful completion of this module, students will be able to:
1. Write programs to solve scientific problems using C/C++.
2. Analyse problems in order to solve them with algorithms and software.
3. Analyse and identify opportunities for refining computer programmes.
4. Manage contributions to group work co-ordinating and co-operating with peers.
On successful completion of this module, students will be able to:
1. Identify different concurrency design spaces.
2. Create software to implement a number of different parallel algorithms and parallel data structures.
3. Apply a range of parallel programming models.
ACS-7: Inversion and optimisation
On successfully completing this course unit, students will be able to:
1. Critique the purpose, opportunities and limitations of inversion and optimisation in practical science and engineering problems.
2. Formulate appropriate inverse and optimisation problems in order to solve physical problems.
3. Explain and solve, mathematically and computationally, linear, non-linear and linearised problems.
5. Find local solutions to non-linear problems.
ACS-8: Machine Learning
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On successfully completing this course unit, students will be able to:
1. Know the basic definitions common to Statistics and Machine Learning (Gaussian Distributions, Maximum Likelihood, Mean Squared Error) and the basic methods of Statistical Supervised Learning (Regression) and Statistical Unsupervised Learning (Principal Components Analysis).
2. Understand the implementation of basic NN algorithms and their building-blocks e.g. Multi-Layer Perceptron’s and Back-Propagation.
3. Understand the Convolutional Neural Networks as the path towards modern Deep Learning and Generative Models, and know how to program using the Pytorch library.
4. Understand the limitations and requirements of Machine Learning algorithms.
Teaching Staff

- Dr Gerard Gorman (Course Director)
- Dr Saskia Goes
- Professor Matthew Piggott
- Dr Gareth Collins
- Prof Stephen Neethling
- Professor Olivier Dubrule
- Professor Mike Warner
Further information:

www.imperial.ac.uk/study/pg/apply/how-to-apply/

www.imperial.ac.uk/earth-science/acse-msc