Unit of Study:	**Computational Projects in Applied Mathematics**	
Lecturer:	Dr Sheehan Olver	
Lectures:	Monday/Tuesday 10:00, in AGR	
Assessment:	Two assignments	66.6%
	Final project	33.3%

Reference Books: There is no set textbook, but lecture slides will be made available online.

For further reading, the student is referred to

1. J.P. Boyd, Chebyshev and Fourier Spectral Methods,

   `http://www-personal.umich.edu/~jpboyd/BOOK_Spectral2000.html`

2. L.N. Trefethen, Approximation Theory and Approximation Practice

   `http://www2.maths.ox.ac.uk/chebfun/ATAP/`

3. L.N. Trefethen and D. Bau III, Numerical Linear Algebra

Description: This unit of study is aimed at highlighting certain fundamental topics in computational mathematics. The course will begin with the fast Fourier transform (FFT), perhaps the most impactful contribution of computational mathematics (if not all of mathematics) from the 20th century. We will utilize the FFT for function approximation and solving differential equations via spectral methods. Solving differential equations will require robust solution of linear systems.

The course will involve two assignments consisting of both implementation and theoretical aspects of computational methods. The final project will be open ended of the students choosing. A proposal will be due 16 April for the lecturer to give suggestions on.

Topics (an approximate guide).

1. Trapezoidal rule and the Euler–McLaurin formula
2. Discrete Fourier transform (DFT) and the fast Fourier transform (FFT)
3. Signal smoothing
4. Global root finding
5. Approximation by Chebyshev series
6. Spectral methods for ordinary and partial differential equations
7. Computation of spectra of differential operators
8. Finite elements for partial differential equations
9. Givens rotations, Householder reflections and the QR decompositions
10. Numerical least squares algorithms
11. The QR Algorithm for calculating eigenvalues
12. Iterative solution of linear systems