

Applied Mathematics at Oxford: Further Reading

Dominic Vella

Spring 2021

Connections to undergraduate courses I mentioned a number of links between the topics of the talk and courses within the Mathematics degree at Oxford. A brief description of these courses is given below, together with a link to the corresponding course webpage.

- First year¹
 - [Introductory Calculus](#) and [Multivariable Calculus](#) introduce some of the machinery needed for the calculus of more than one variable.
 - [Fourier Series & PDEs](#) introduces some analytical techniques for finding the solutions of each of the three equations (Wave, Diffusion and Laplace) that I discussed.
- Second year
 - Laplace’s equation is used extensively to understand how fluids flow, and therefore makes up a large portion of the course [Fluid Dynamics & Waves](#).
 - A first course on the algorithms needed in many other problems is the subject of [Numerical Analysis](#).
 - The SIR model for the spread of infectious diseases is introduced in the course [Mathematical Modelling in Biology](#).
- Third Year (and beyond)
 - More advanced techniques for the solution of the wave equation are introduced in the third year course [Waves & Compressible Flow](#), which also discusses eigenfunctions in 2D and 3D (including those of a circular drum).
 - Pattern formation in biological systems, including animal patterning, is discussed in the third year course [Further Mathematical Biology](#).
 - Detailed studies of the numerical methods needed to solve the Diffusion Equation in [Numerical Solution of Differential Equations I](#) and of the Wave and Laplace equations in [Part II](#).
 - Laplace’s equation, and its solutions, reappear in [Electromagnetism](#).

Some light reading and viewing

- Many more examples in the spirit of those given in the talk are discussed in the book ‘[A Very Short Introduction to Applied Mathematics](#)’ by Alain Goriely.
- The essay ‘[On being the right size](#)’ by J. B. S. Haldane presents an entertaining discussion of the implications of scalings and dimensional analysis in biology.
- A public lecture by Robin Thompson describing mathematical modelling of infectious diseases (including the Covid-19 outbreak and the answers to some questions) can be found [here](#).

¹Links are given to the 2019/20 page because more recent ones are hosted elsewhere.