Applied Mathematics at Oxford: Further Reading

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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 year
  - 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.