characters, but one gradually warms to Freddy and Pete – a less zany pair than Ian Stewart's Soames and Watsup (see the July 2015 *Gazette*). For the narrative to be compulsive reading I imagine that one would need to be an aficionado of west-coast culture – inter-college basketball, soaps and NFL. But the writing is cheerful, and there are some good stings in the tails of several of the stories.

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The Princeton companion to applied mathematics edited by Nicholas J. Higham, pp. 1016, £69.95 (hard), ISBN 978-0-691-15039-0, Princeton University Press (2015).

This book (hereafter referred to as PCAM) is a sequel of sorts to the well-regarded *Princeton Companion to Mathematics*, published in 2008. In terms of general format, the books have a lot in common. Both are huge (roughly 1000 pages each, and roughly the size and shape of a telephone directory for a good-sized city), and each consists of scores of individual articles, by many (165, for this volume) different authors, covering numerous aspects of the subject of the title. And both are astonishing pieces of work, true labours of love on the parts of the editors and contributing authors.

Like its predecessor, PCAM is divided into eight parts. Part I is an introduction consisting of six essays, discussing various aspects of applied mathematics, including the meaning of the term 'applied mathematics', the history of the subject, and its basic vocabulary. Of course, the phrase 'applied mathematics' now encompasses far more than things like physics and differential equations; it reaches into discrete areas like linear algebra, graph theory and combinatorics, and others as well. The essays in this part (all but one of which were written by Nicholas Higham, the editor-in-chief of this volume) give a good introduction to the scope of the subject. The first ('What is Applied Mathematics?') and last ('The History of Applied Mathematics') were, I thought, the high points of this Part, but obviously this is a purely subjective view.

Part II is entitled 'Concepts' and consists of 36 essays, typically very short (one or two pages long), each one discussing in broad outline some specific concept of applied mathematics. Illustrative titles here include 'Function spaces', 'Conservation Laws', and 'Graph Theory'. The essays in Part III discuss (again, generally quite briefly) some law or formula of applied mathematics. So somebody wanting to quickly find out what the Cauchy-Riemann equations are, or what the Dirac delta function is, can find out in a hurry.

Part IV, which amounts to almost half the book, surveys (in 40 longer articles) many of the diverse branches of applied mathematics. Illustrative examples include ordinary and partial differential equations (one article each), special functions, spectral theory, random matrix theory, fluid dynamics, signal processing, and general relativity and cosmology, but there are a lot more.

Parts V and VI discuss, respectively, modeling and illustrative problems. (I mention them together here because I'm not sure what the line of demarcation between them is: the flight of a golf ball, for example, is treated in chapter VI, but I suppose a respectable case could be made that it is an example of mathematical modeling.) Whatever the headings of these two parts are, however, the articles cover all sorts of fascinating topics: not just golf, but also, for example, cardiac modeling, robotics and random number generation.

Part VII discusses areas in which applied mathematics is, well, applied. These articles, averaging about four or five pages each, also touch on a huge variety of areas, ranging from aircraft noise to modeling a pregnancy kit (I'm not quite sure why this wasn't a 'model' within the meaning of Part V) to mathematical economics to analysis of voting systems. There are 25 articles in all.

Part VIII is the most quixotic of the eight. It is titled 'Final Perspectives' and consists of an assortment of articles, some of whose relevance to the area of applied mathematics seem questionable: Ian Stewart, for example, writes on how to write a general interest mathematics book, and Heather Mendick has a piece on how mathematics is represented in the popular media. While these may seem somewhat out of place in a book of this nature, I think it would be churlish to complain about them; I found both of these articles to be quite entertaining, in fact.

The above description of the text is necessarily not exhaustive. Obviously this review would be ridiculously overlong if I attempted to give an indication of everything that can be found in this book. Suffice it to note that the table of contents (three pages, small type, two columns per page) is easily found online, as, for example, in the publisher's webpage for the book.

A natural question to ask is: who are the intended readers of the book? The articles themselves vary in level of difficulty, with some (inevitably) requiring more mathematical knowledge as a prerequisite than others, but by and large I would think that any upper-level undergraduate, at least, should be able to read a great deal of this book with considerable profit. I can't imagine very many people will want to sit down and read this cover-to-cover (I confess that I didn't), and it is hardly suitable as a text for a course. But as a reference, it is superb. Its value is enhanced by the presence of an excellent 32-page index, and by some cross-referencing among the articles. 'Drop-in' readers will find much to entertain and inform them here, and these readers appear, to me, to be the natural constituency for this book.

In short: this book took years to produce, and that effort shows in the excellent final product. I think that many mathematicians, even those who do not consider themselves applied mathematicians, would benefit from having this book on their shelves, and of course it goes without saying that it belongs in any decent university library.

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From music to mathematics by Gareth E. Roberts, pp. 320, $49.95 (hard), ISBN 978-1-42141-918-3, Johns Hopkins University Press (2016).

There have been many books and articles attempting to explore the link between mathematics and music, but this is something different, a coursebook for a university course on mathematics and music. The author's aim is to motivate the mathematics by examples drawn from music. The mathematics ranges from transformation geometry to group theory by way of Fibonacci numbers (here given an alternative title of Hemachandra numbers), magic squares and sine waves. Most readers familiar with both subjects will know what sort of musical references to expect (although Roberts draws almost as many examples from popular music as from classical), but the level of discussion is much higher than the norm; as appropriate for an undergraduate course, it includes exercises at the end of each chapter (though not very many). It is perhaps hard to imagine a student beginning such a course who has to have explained what a clef is, while at the other end of the spectrum the reference to ODEs seem a bit advanced for a student who has not met calculus at school. The idea of a university course like this in resolutely specialist Britain is bound to seem an anomaly, but even without the pretext of a formal course the book is valuable at various levels.