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THE FIRST RESOURCE FOR MATHEMATICS

Duffy, Dean G.

Advanced engineering mathematics. A second course. (English) Zbl 1497.00002

Advances in Applied Mathematics (Boca Raton). Boca Raton, FL: CRC Press (ISBN 978-1-032-13342-3/hbk; 978-1-032-22345-2/pbk; 978-1-003-27220-5/ebook). xvii, 447 p. (2022).

The author's book on Advanced Engineering Mathematics from 1998 became too voluminous to contain all the possible topics. After some experimentation with the arrangement of the different topics, it was decided to split it up in in two volumes. With the curriculum at a number of institutes in mind, the following division was decided. The first book [*D. G. Duffy*, Advanced engineering mathematics with MATLAB. 5th edition. Boca Raton, FL: CRC Press (2022; Zbl 1487.00002)] collects the subjects that appear most commonly in advanced engineering courses and can thus be produced in large quantities. In the other part, here under review, the topics are a bit more specialized. The successive chapters treat (1) complex functions, (2,3,4) Laplace, Fourier, z-, and Hilbert transforms, (5) Green's function, (6,7,8) probability, random processes, and Itô's stochastic calculus. This gives essentially two parts: (1–5) aiming at students in electrical engineering and communication, while (6–8) points towards the increasing importance of stochastic models for physical systems.

Fourier and Laplace transforms appear also in the other volume, but here, use is made of the complex function theory developed in chapter 1, to invert these transforms and apply them to integral and partial differential equations. The second part with stochastic processes (Brownian motion, Poisson and birth and death processes) and stochastic differential equations are less traditional topics in this kind of courses.

The principles and ideas of previous editions are maintained. The book clearly aims at engineering students because the main focus is on solving problems. After motivating and defining the concept or technique, properties are obtained but hard proofs are avoided as much as possible. A few books are suggested for proofs and further reading. There are however many examples instead that make the result plausible, and, although it is not in the title, also this book includes at many places matlab code that can be used for experimentation. The main focus is on the use of the mathematical formulas that solve the problems, no special attention is paid to advanced numerical analysis that is needed for more real life problems. That should be discussed in a different course. Like any similar set of lecture notes, there are many exercises included. The answers to the odd numbered ones are listed at the end.

Reviewer: Adhemar Bultheel (Leuven)

MSC:

00A06 Mathematics for nonmathematicians (engineering, social sciences, etc.)
44-01 Introductory exposition (textbooks, tutorial papers, etc.) pertaining to integral transforms
60-01 Introductory exposition (textbooks, tutorial papers, etc.) pertaining to probability theory

Keywords:

complex numbers; Cauchy-Riemann equations; complex differentiation; complex integration; residu theorem; Cauchy's principal value; Laurent series; Fourier transform; Laplace transform; differential equations; wave equation; heat equation; Laplace equation; z-transform; difference equations; Hilbert transform; Kramer-Krönig relation; Green's function; Helmholtz equation; Galerkin method; probability; random variables; power spectrum; Markov chain; birth and deat process;Poisson process; stochastic differential equation; Brownian motion; random walk; Itô's stochastic integral

Software:

Matlab

Full Text: DOI

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