Book Reviews

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BOOK REVIEWS

A. C. Fischer-Cripps: THE MATHEMATICS COMPANION – MATHEMATICAL METHODS FOR PHYSICISTS AND ENGINEERS. Second edition, CRC Press, Boca Raton, 2015, xv + 286 pages, paperback, ISBN-13: 978-1-4665-1587-1.

The book summarizes basic notions of mathematical methods for physicists and engineers in a schematic way. It is aimed both at science students and at physicists who need a quick handy reference when they have to solve a specific mathematical problem. It has been written by a physicist.

It consists of three parts for a total of 24 chapters, plus one appendix (almost 300 pages altogether). It does not contain any proofs. It provides a few examples but no problems to solve.

Part 1 "Mathematics Essentials" reviews basics notions such as: real and complex numbers; basic coordinate systems in three dimensions; vectors in two and three dimensions; basic trigonometric formulas; simple notions of analytic geometry; limits and functions of one real variable; integration in one dimension; exponential, logarithmic and trigonometric real functions, and their main properties; very basic notions of harmonic motion and one-dimensional waves; infinite series; simple notions of statistics and probability theory; basic properties of matrices. Most of Part 1 is at the level of last year high-school students.

Part 2 "Advanced Mathematics" goes on reviewing ordinary differential equations (including linear systems) and basic methods of solution; Laplace transforms and applications to ordinary differential equations with constant coefficients; vector analysis in three dimensions with simple applications to mechanics (motion of a point); partial derivatives of real functions in two and three dimensions (including critical points and Lagrange multipliers); multiple integrals in two and three dimensions, and divergence theorem, theorems of Gauss, Stoke and Green (including both integral and differential form of Maxwell's equations); Fourier series and transform; partial differential equations in two variables (discussing, in particular, the wave and heat equations); and numerical methods such as Newton's, interpolating polynomial, finite element method, etc.

Part 3 "Applications" summarizes physics problems such as: simple electric circuits (permittivity, capacitance, series and parallel impedance); solid mechanics (Hook's law, stress, strain, stress tensor, etc.); signal processing (transfer function, transforms and operators, low pass filter, etc.); Fourier optics (diffraction, Fourier transform, single and double slit, lenses); quantum mechanics (Schroedinger equation in one dimension, probability density function—and applications such as free particle, particle in a box, step potential, finite square well, potential barrier, harmonic oscillator, hydrogen atom—basics of perturbation theory and variational method, helium atom, transition rates, etc.).

The appendix consists of three pages and is devoted to summarizing very basic formulas of Euclidean geometry and trigonometry, standard integrals and a few special functions (gamma, beta, error, Bessel functions, and the exponential integral).

Marcello Ortaggio
(Institute of Mathematics, Academy of Sciences, Prague)