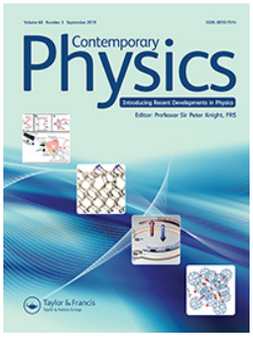

Contemporary Physics

ISSN: 0010-7514 (Print) 1366-5812 (Online) Journal homepage: https://www.tandfonline.com/loi/tcph20

Mathematical methods in science and engineering, 2nd edition

by Selçuk S. Bayin, Hoboken, NJ, Wiley, 2018, 864 pp., £125.00 (hardback), ISBN 978-111-9425-39-7. Scope: textbook. Level: advanced undergraduate, postgraduate, researcher, scientist, engineers.

Miguel A. F. Sanjuán

To cite this article: Miguel A. F. Sanjuán (2019) Mathematical methods in science and engineering, 2nd edition, Contemporary Physics, 60:3, 263-263, DOI: 10.1080/00107514.2019.1641159

To link to this article: https://doi.org/10.1080/00107514.2019.1641159

Published online: 22 Jul 2019.

Mathematical methods in science and engineering, 2nd edition, by Selçuk S. Bayin, Hoboken, NJ, Wiley, 2018, 864 pp., £125.00 (hardback), ISBN 978-111-9425-39-7. Scope: textbook. Level: advanced undergraduate, postgraduate, researcher, scientist, engineers.

Definitely, *Mathematical Methods in Science and Engineering*, second edition, is a textbook providing numerous mathematical techniques and tools that may be applied to different scientific and engineering disciplines. Most of these applied mathematical methods have been used particularly in theoretical physics. Nevertheless, the idea of the new edition is to expand the applications beyond physics, to numerous other scientific disciplines such as chemistry, biology, economy, and finance, showing the utility of these advanced mathematical methods.

The book is organised into 19 chapters, where the different mathematical methods are included. Even though the book lacks sections or parts, the first eight chapters are devoted to special functions, such as Legendre, Laguerre, Hermite, and Chebyschev polynomials, including special functions such as Bessel and Hypergeometric functions, and the Sturm-Liouville theory. The structure of each chapter is rather similar, and contains a detailed description of the subject matter with applications in physics and other disciplines. Some interesting particular examples of applications are included, and at the end of each chapter there is a brief and useful bibliography on the topic and its applications, and a collection of unsolved problems. Among the applications, there are examples in classical and quantum physics, and computer graphics.

An interesting and rather comprehensive chapter focuses on coordinate systems, vectors, tensors, and generalised coordinates with special applications to special relativity and the theory of elasticity. Besides being self-contained, it can be used independently from the rest of the book, providing an excellent overview of its applicability to science and engineering, and in this case to physics.

Group theory, including Lie groups and Lie algebras, is contained in another chapter, considering ideas of symmetries in whatever discipline in physics. It can be useful to refresh the ideas for those who already know, or to learn them from those who do not know, in any case in a synthetic manner. A couple of chapters consider complex variables and integrals, with numerous applications to electrostatics and fluids, where some special functions such as Gamma and Beta functions are included. Fractional calculus, its mathematical techniques and applications to science and engineering constitute another chapter. Much research is currently underway using techniques from fractional differential equations so that this chapter is a good asset for that purpose. Another group of chapters includes infinite series, Fourier and Laplace transformations and integral transformations. Variational analysis and applications to classical mechanics and Hamiltonian equations and Hamilton principle with applications to control and dynamics are the subjects of another chapter. Finally, one chapter covers integral equations with applications, and Green's functions, path integrals and path integral Feynman formulation of quantum mechanics are offered in the final chapters.

Precisely in relation to mathematical methods for the sciences, it is a pity that the terminology and the nomenclature are not unified, since this can contribute to a certain confusion. Traditionally this has been the case with certain topics such as vectors and tensors, as well as others, which receive different notations in areas of physics, engineering and applied mathematics. A greater unification would be important, since fortunately, as this textbook shows, the methods are of general application to the sciences and engineering.

It would have been desirable that new references would have been added to the bibliography in the second edition. Another aspect that would have much improved the book would have been to classify the different techniques and methods in sections or parts. Furthermore, in spite of the importance and relevance that nowadays have the computational methods and numerical algorithms, these are lacking in the textbook.

The text can be used for the classroom, as well as a reference for students and researchers. As I commented earlier, many chapters or groups of chapters can be read independently from one another, so it can be used also for self-study. In any case, it gives the readers the strong foundation needed to apply mathematical methods to the physical phenomena found in scientific and engineering applications. From this perspective, the book can be of interest to a wide audience, ranging from postgraduates and researchers in physics, engineering and other scientific disciplines interested in advanced mathematical methods of analysis.

Miguel A. F. Sanjuán
Universidad Rey Juan Carlos
miguel.sanjuan@urjc.es
http://orcid.org/0000-0003-3515-0837

https://doi.org/10.1080/00107514.2019.1641159

Applied symbolic dynamics and chaos, 2nd edition, B. Hao and W. Zheng, Singapore, World Scientific, 2018, 500 pp., $168.00 (hardback), ISBN 9789813236424. Scope: monograph. Level: postgraduate, early career researcher, researcher, scientist.

The book *Applied Symbolic Dynamics and Chaos*, second edition, belongs to a series of books in advanced physics.