BOOK REVIEWS

Finite Element Method: With Applications in Engineering. Y. M. Desai, T. I. Eldho and A. H. Shah. Dorling Kindersley (India) Pvt Ltd, 7th Floor, Knowledge Boulevard, A-8(A), Sector-62, Noida 201 309. 2011. xviii + 470 pp. Price not mentioned.

The book is a recent addition in the literature of finite element methods (FEM). Though there are several books belonging to this category available in India, this book is special as it reflects the wisdom of the three authors having expertise in different domains of engineering.

The book contains ten chapters, seven appendices and one CD containing computer programs. Each chapter contains a list of references at the end. With the exception of the first chapter, a set of exercise problems are also given at the end of the other chapters.

Chapter one contains a general overview on mathematical modelling of engineering problems, which has been supplemented with a generalized flow-chart. Starting with an example of differential equations and their solution methodology, the general philosophy of FEM is stated. In this chapter the authors have also given helpful suggestions on how to use the book.

Chapter two briefly presents various approximate methods. In particular, method of weighted residuals (collocation-based methods, least square-based methods, Galerkin method) and Rayleigh–Ritz method are illustrated.

Chapter three formally presents the general approach of FEM as to how it works, its history, its limitations as well as various application-domains.

Chapter four illustrates FEM formulation of a typical element as well as global concepts with the help of 1D examples. Chapter five is a treasure-house of inter-polation functions for 1D, 2D and 3D elements. Students will find this chapter extremely helpful.

Chapter six is devoted to 1D finite element formulation covering spring, bar, beam and shaft elements. Illustrations have been given on plane truss, space truss, plane frame, grid as well as space frame. The illustrations also include I–D examples of heat conduction, flow theory of porous media, and flow networks which may be a source of confusion for readers not familiar with specific domain.

Chapter seven discusses 2D engineering problems. There are illustrations on seepage flow using three-node triangular element. Next, problems of 2D elasticity and axisymmetry are illustrated again with three-node triangular element and later with rectangular element.

The isoparametric elements are introduced with illustration of 1D and 2D (four-node quadrilateral element) elements. There is a section on solution of partial differential equations (PDE) using weighted residuals. Further, FEM formulation based on variational approach is also given. This is followed by FEM solution of Strokes flow equation. The authors have tried to pack too much material from different engineering domains, which may be difficult to comprehend for a beginner to FEM.

Chapter eight is dedicated to 3D analysis. However, the chapter starts with axisymmetric problems with non-symmetric loads. Next, the finite element formulation of an eight-noded hexahedral element is illustrated. The treatment of 3D analysis is rather too short.

Chapter nine is dedicated to computer implementation of FEM. Chapter ten attempts to cover further applications of FEM to various areas such as plates and shells, vibrations and dynamics, nonlinear problems, ground flow and contaminant transport modelling, hydrodynamic simulation, etc. This seems to be an ambitious approach to include too many topics in a basic book on FEM.

The coding given is in FORTRAN, which may seem a bit outdated considering several new programming languages/ environments being available these days. The CD containing the FEAP program with user's guide given in the appendix may be of help to FEM enthusiasts.

I have been teaching courses on FEM for over three decades and have always felt the need for a suitable text book. This book is a good teaching companion which can be used to supplement the requirements of FEM courses.

Finally, this is a well-conceived, good reference book on FEM, but has shortcomings as a textbook. I complement the authors for coming out with this book covering several domains of application. However, adaptivity and error estimation have not been mentioned, which should be discussed in a book on FEM.

It is hoped that in the next edition of the book the authors will address some of the issues raised in this review.

In summary, this book will be useful for those teaching FEM. It will also serve as an excellent reference for students of senior undergraduate or graduate programmes. The book is reasonably priced and I recommend it as an introductory reference book on FEM.

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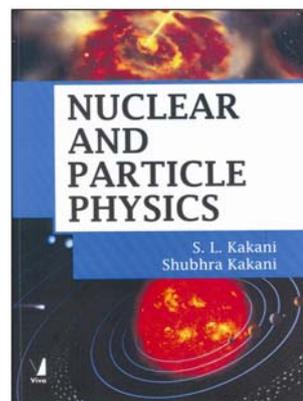
Nuclear and Particle Physics. S. L. Kakani and Shubhra Kakani. Viva Books Private Limited, 4737/23, Ansari Road, Daryaganj, New Delhi 110 002. 2008. ix + 965 pp. Price: Rs 495.

The study of nuclear and particle physics is one of the frontier areas of physics. A number of Indian authors have written books on nuclear physics both at the introductory and advanced levels. The present book by S. L. Kakani and Shubra Kakani is one more addition to the collection of books on nuclear and particle physics.

First I would like to compliment the authors for their sincere effort in bringing out the book, especially considering the fact that they are not specialists in this field. The book is aimed at students of B Sc (Hons), M Sc and M Phil in physics. The authors have dealt with the topic in the conventional manner, starting with nuclear properties, moving on to nuclear forces, followed by nuclear structure and ending with a discussion on nuclear reactions. A good discussion on neutron physics and nuclear energy has been provided. Charged particle accelerators and radiation detectors, which are the tools for nuclear and particle physics research, are covered in the subsequent chapter. The last chapters are related to particle physics and cosmic ray physics.

On the whole, the authors have done justice to this broad area of nuclear and particle physics. When I received the book from *Current Science*, I was impressed by the quality of publication in terms of print, which is indeed reader friendly. The book is written in a style that is useful for students. Every chapter has references, review questions, problems, short question–answers and objective question–answers. This format deserves appreciation.

However, the book has several deficiencies which need to be addressed. Broadly, I will summarize the errors in three categories: (i) Imprecise information: for e.g., on page 949, the half life of neutron is given as 12 min; the actual value is 10.24 min as per the Nuclear Wallet Cards (BNL, NNDC). The half life of Tritium is given as 12.26 yrs; the actual value should be 12.32 yrs. (ii) Wrong spellings/typos: for e.g. on page 812, q. 5 answer – spelling of linac, circular. I am not aware of any accelerator which is called static – it could be DC accelerators. (iii) Incorrect statements/ expressions: for e.g. on page 553, thermal neutron energy is 0.025 eV and not 1 eV. Page 788 has incorrect statements regarding accelerators at various institutes – the 5.5 MeV accelerator was decommissioned nearly 10 years ago; it was in BARC and not at TIFR. Similarly, the 2 MV tandem was decommissioned long time ago. Right now, a 6 MV FOTIA is operational at BARC.

In the reference section, there are a number of notable omissions; for e.g., *Int. Nuclear Physics* by K. S. Krane, John Wiley; *Radiation Detectors and Measurements* G. F. Knoll, John Wiley. The

authors should remove these deficiencies and provide a table containing errata.

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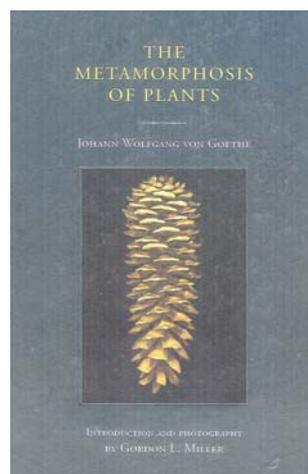
The Metamorphosis of Plants. Johann Wolfgang von Goethe. Introduction and Photography by Gordon L. Miller. The MIT Press, 55 Hayward Street, Cambridge MA 02142, USA. 2009. xiv + 123 pp. Price: US$ 21.94.

The Metamorphosis of Plants written by the German polymath Johann Wolfgang von Goethe, belongs to a rare category of works that bring fresh insights each time a reader explores it or a researcher interprets its main theme. Goethe was a literary giant and the author of the famous play *Faust*, deeply interested in the theory of colours and the science of optics and 'diversity of plant form'. The mineral Goethite, hydrated ferric oxide, is named in the honour of the poet. Goethe coined the term morphology for the study of organic form, especially the unity of type that formed the basis of all form. 'The Metamorphosis…' was first composed as a poem and later as a short preliminary treatise with 123 paragraphs. Goethe was planning a more comprehensive account that would contain illustrations to meaningfully explain his perception of a flowering plant. It was during a visit to Palermo, in the Island of Sicily that

Goethe was exposed to a wider variety of plants in the more sunny surroundings. He collected many plants and made a few interpretive sketches and also got some drawn by professional artists. Had he visited tropical Asia, he would have been baffled by the majesty of trees such as the banyan! Goethe was seeking a simple archetypal plant the *Urpflanze*. In his intense search for the basic unit that could create any form of plant, it suddenly dawned on him that it was the leaf, some kind of Próteus (an ancient Greek sea-god who assumes many shapes to evade having to foretell the future) that could create any kind of plant.

Miller has written a scholarly and beautiful introduction after a thorough study of the previous and contemporary literature. He has fathomed the passion of Goethe through the imagery created by the mind and the eye, which he states brings together not only poetry and science but art and science as well. Miller is a renowned historian and director of the inter-disciplinary environmental studies program of the Seattle University, Washington State University, USA, an unthinkable combination in India. A gifted photographer, Miller has tried to search for the plants listed in Goethe's book or their close relatives in the flora of the west Washington State and in the gardens, yards of neighbours and florist shops. He has added 60 superb colour plates to Goethe's book to present the full range of modifications the plants undergo,

Vegetative and reproductive organs displayed in 'Coral Nymph' salvia (*Salvia coccinea*).