The Linearized Theory of Elasticity, William S. Slaughter, Birkhauser Verlag AG, P.O. Box 133, CH-4010, Basel, Switzerland. 2002. 543 pp. Price: sFr 158/Eur 98.13.

The subject of solid mechanics deals with analysis of displacements, strains and stresses in deformable bodies[1]. In elasticity theory, attention is restricted to understanding the mechanics of materials that possess the property of recovering their original shape when the forces causing the deformation are removed. Many structural materials, in particular engineering alloys, display a stress-versus-strain relationship which is linear (or Hookean) in the elastic range (prior to onset of yielding). Further, the strains (or displacement gradients) are very small compared to unity in the above range. For example, the strain associated with the threshold of elastic response (i.e. the yield strain) in steels could be between 0.001 and 0.005. Hence, the linearized theory of elasticity is sufficient to accurately describe the response of many engineering components and structures such as steel bridges, aircraft parts, automobile shafts and rotating turbine blades to different types of mechanical loads. Indeed, a thorough understanding of this theory is essential in order to design such components and ensure that they have adequate strength and stiffness to withstand the loads encountered in service without experiencing failure.

Due to the above reasons and also because of its multi-disciplinary nature, the linearized theory of elasticity forms an important subject in curricula of both undergraduate and graduate programmes in mechanical, civil and aerospace engineering. At the undergraduate level, it is generally taught under the title of 'Strength of materials', whereas a graduate level course may be entitled as 'Theory of elasticity' or as 'Mechanics of solids and structures'. The former is based on several engineering assumptions which enable the theory to be simplified and presented to undergraduate students. The graduate level course is generally much more rigorous in mathematical treatment.

The book under review contains material which is ideally suited for such a course. It can also serve as a good reference for practising design engineers. Although many books have been written on this subject (see, for example, refs 1–3), the present book is attractive due to many notable features. It begins with a comprehensive introduction to tensor analysis. Several concepts pertaining to tensors such as transformation rules, eigenvalues and vectors, gradients, etc. are succinctly presented. Although the author mainly adopts Cartesian axes (and base vectors) for this purpose, which is indeed sufficient for most structural problems, a concise summary of tensors using general curvilinear coordinates is included as Appendix A. All these concepts are employed in subsequent chapters on analysis of strain, stress and constitutive equations.

The kinematics, conservation laws and constitutive equations are first described within the framework of a finite deformation theory using both referential and spatial formulations. Appropriate strain and stress measures are introduced for this purpose. The assumptions involved in kinematic linearization are carefully laid out. The implications of the linearization assumptions on the above quantities as well as the stress–strain relationship (i.e. applicability of the generalized Hooke's law) are clearly delineated. This approach would enable the reader to appreciate the distinction between a finite deformation analysis and a linearized treatment of problems in solid mechanics.

The field equations of linearized elasticity are summarized and types of boundary conditions (displacement and traction boundary conditions) are outlined. The author discusses some useful principles in linear elasticity such as the superposition principle, St. Venan't principle and uniqueness of solution. These are of immense value when finding solutions to practical engineering problems. The author then addresses classical topics in linear elasticity such as two-dimensional plane strain, plane stress and anti-plane strain problems, St. Venant's torsion theory (of non-circular shafts), some three-dimensional problems and complex variable methods. The same level of mathematical rigour as in earlier chapters is maintained throughout the discussion of these topics.

Further, in order to clearly illustrate the solution methods such as Airy's stress function approach, worked out examples as well as exercise problems are included at the end of each chapter. The latter will be particularly valuable for graduate students to supplement their understanding of the theory. In the course of the above treatment, the author discusses some advanced topics such as Eshelby's inclusion problem and complex variable solution to asymptotic crack tip fields, which are generally not found in other similar textbooks. Finally, the book contains a chapter on energy theorems in elasticity and an approximate solution procedure using Rayleigh–Ritz technique. A self-contained introduction to calculus of variations is included in this chapter.

Thus, this book, which is well organized and lucidly written, provides an excellent mathematical foundation to the linearized theory of elasticity. However, the author could have also emphasized the physical and engineering aspects of the theory in some chapters. For example, in chapter 4, the author uses the traction–stress relation in order to establish the character of stress as a second-order tensor. The application of results from tensor analysis outlined in chapter 2 leads immediately to important concepts such as transformation of stress components under an orthogonal change of basis, eigenvalues (principal stresses) and eigenvectors. Also, the localization argument is applied to the global balance of linear and angular momentum to derive the equations of motion and show that the Cauchy stress is symmetric (which holds at every point in the continuum). Although this approach is perfectly correct from a mathematical standpoint, first-year engineering graduate students will appreciate it better if transformation equations for stress components and local equations of equilibrium are also derived using more elementary methods such as those adopted by Fung[1]. This could have been included in chapter 4 and the elaborate (and repetitive) presentation of the stress measures and the balance laws in material and spatial formulations could have been condensed. Similarly, in chapter 10, expressions for potential energy for simple elastic systems such as beams could have been derived. Also, application of the Rayleigh–Ritz method to such systems would have been more illustrative than the complicated torsion problem that is considered. However, it must be mentioned that these examples are introduced by the author through the exercise problems at the end of chapter 10. Finally, a brief introduction to thermal stresses and stress wave propagation would have further enhanced the utility of this book. Nevertheless, these comments do not in any way undermine the quality of this book, which as already mentioned, will serve as an outstanding textbook for graduate students in engineering.

1. Fung, Y. C., *Foundations of Solid Mechanics*, Prentice-Hall, Englewood Cliffs, New Jersey, 1965.
2. Sokolnikoff, I. S., *Mathematical Theory of Elasticity*, Krieger Publishing Company, Florida, 1956, 2nd edn.
3. Timoshenko, S. P. and Goodier, J. N., *Theory of Elasticity*, McGraw Hill, New York, 1970, 3rd edn.

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Radio Frequency Principles and Applications – The Generation, Propagation, and Reception of Signals and Noise. Albert A. Smith (ed.). Universities Press (India) Ltd, 3-5-819, Hyderguda, Hyderabad 500 029. 2001. 217 pp. Price: US$ 89.95. (original price). Rs 215 (special Indian price).

Radio Frequency (RF) techniques and technology have undergone a paradigm shift over the past decade, owing to the expansive market in wireless communications as well as in industrial, scientific and medical fields. With the utility of increasingly higher frequencies in these applications, the field of RF engineering has broadened to encompass microwave techniques. The book under review in its seven chapters, offers a broad overview of the basics of diverse areas that constitute RF engineering to suit the needs of practising RF engineers.

The book begins by introducing the basic laws of electrostatics and magnetostatics in chapter 1. Chapter 2 deals with time-varying electromagnetic fields along with some practical examples. Chapters 3–7 cover diverse areas; namely propagation, antennas, RF environment, waveforms and spectral analysis, and transmission lines. There is exhaustive literature in the form of published papers and books on each of these areas. The author has extracted the essential topics and information from the published literature and has presented them in a compact form under a single cover. Each chapter presents the basic principles and definitions pertaining to the topic in a lucid and understandable manner. Without going into any detailed mathematical derivations, the author has presented the essential formulas along with the necessary theoretical base and applications so as to be useful to practising engineers.

Chapter 2 begins with Maxwell's equations and boundary conditions, and then presents the theory of plane wave incidence at a metal surface leading to the concept of skin depth, and shielding effectiveness of metal sheets in practice. Next, time-varying fields due to an elementary dipole and a small loop are introduced followed by practical examples of microwave oven and personal computer to illustrate the concepts of near- and far-field regions. This chapter also addresses in brief, the commonly posed question of human exposure to electromagnetic radiation. Chapter 3 offers a brief overview of free space propagation, and ground-wave propagation over plane earth. Relevant formulas and characteristics of different propagation modes are summarized. Practical aspects such as attenuation due to ground, buildings, edge diffraction and Raleigh roughness criterion are covered.

Chapter 4 first provides, the definitions and basic formulae of antenna parameters. The reciprocity theorem is discussed next, followed by a review of the essential features of different types of antennas used for measuring electromagnetic fields, and methods for calibrating receiving antennas. Chapter 5 discusses RF environment from the point of view of electromagnetic noise and interference. The various noise parameters are reviewed, followed by a discussion on a receiving system, its sensitivity, received noise voltage and noise figure. Salient characteristics of extraterrestrial noise, atmospheric noise, man-made radio noise, power line-conducted noise, and the earth's magnetic and electric fields are included. Chapter 6 presents the basics of waveforms and spectral analysis. The topics covered are Fourier transform, spectral intensity of deterministic energy signals and Fourier series of periodic power signals.

The last chapter is on transmission lines. In addition to the basic two-wire transmission line theory, this chapter deals with the excitation of two-wire line and single conductor above a ground plane by external electromagnetic fields and also radiation from transmission lines. Appendices are included that list information on physical constants, electrical units, wave relations, math identities, vector operators and frequency bands.

On the whole, the book offers a fine compilation of useful, practical information and should serve as a ready reference to practising RF engineers. Unlike the conventional reference data handbooks, this book includes, in each chapter, the basic principles and the necessary theoretical aspects without going into complicated mathematical derivations. With this theoretical base, the book makes a useful reference to graduate students in electromagnetics and microwaves. Portions of the book dealing with practical applications should prove useful to teachers to enrich classroom teaching in the area of RF and microwave engineering.

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Annual Review of Immunology, 2002. William E. Paul, C. Garrison Fathman and Lauri H. Glimcher (eds). Annual Reviews, 4139 El Camino Way, P.O. Box 10139, Palo Alto, CA 94303-0139, USA. Vol. 20. 956 pp. Price not mentioned.

The *Annual Review of Immunology* (*ARI*) continues to be one of the most endearing publications which every student of immunology, young or old, looks forward to. The most important of all the articles that appear in the *ARI* is the prefatory chapter. This chapter from Kabat to Eisen has provided a broad view of major developments in immunology over the years. The volume under

Theory of Elasticity. Introduction. The Hookean Solid. An Alternative Development of the Generalized Hooke's Law. Strain Energy. Two-Dimensional Theory of Elasticity. Plane Stress. Plane Displacements.Â Torsion of Cylindrical Bars. The Coulomb Theory of Torsion. The Saint-Venant Theory of Torsion. Prandtl's Stress Function. The Membrane Analogy. Linear elasticity is a mathematical model of how solid objects deform and become internally stressed due to prescribed loading conditions. It is a simplification of the more general nonlinear theory of elasticity and a branch of continuum mechanics. The fundamental "linearizing" assumptions of linear elasticity are: infinitesimal strains or "small" deformations (or strains) and linear relationships between the components of stress and strain. In addition linear elasticity is valid only for stress