random loading), fracture (initiation and propagation) and notched-type behavior. The authors cover all of the abovementioned topics in a very authoritative manner. After discussing an idea in a paragraph, the authors employ a "sum-up" feature written in simple language. The book consists of 7 chapters.

Chapter 1 introduces the subject of fatigue via S/N diagrams. Chapter 2 considers cycle stress-strain response. The authors explain the difference between monotonic and cyclic stress-strain curves and, in addition, consider microstructure of metals and theories of hardening and softening. Chapter 3 focuses on fatigue crack nucleation with special reference to dislocation structures and concludes with the mechanisms of crack initiation. Chapter 4 encompasses the broad subject of fatigue crack propagation, including the mechanics of crack growth and fracture mechanics applied to crack growth, with both elastic and elastic-plastic solutions. Everything is presented in simple language. The chapter concludes with miscellaneous factors affecting crack propagation rate, i.e., corrosive environment, thickness, and temperature. The reviewer would have preferred seeing a short discussion on the J integral.

Consider Chapter 5 as the mainstay of the book. The primary subject involves fatigue-life curves. The authors initiate the readers in the understanding of the Coffin-Manson equations and some of its variants. Among the additional subjects covered are high-cycle fatigue with brief mention of low-cycle fatigue, effect of mean load and hysteresis energy, fatigue limit, size effect and curves of constant damage. At all times, the authors apply fracture mechanics where warranted and show how it is intermeshed with the general theory of fatigue. This chapter is good reading.

Chapter 6 is most interesting. The authors provide an excellent discussion of notched behavior and further consider the elastic-plastic solution with special emphasis on Neuber's rule. A number of empirical rules are furnished which leads into crack propagation. The relationship between K_f (fatigue reduction factor) and K_t (stress concentration factor) is nicely explained. Although brief, this is a chapter that should be read by all.

The concluding chapter briefly considers fatigue life subjected to random loading. This is a most welcome addition since most texts omit this subject. The authors discuss block spectrum loading, level crossing method, and cumulative frequency method. Miner's rule is discussed due to its simplicity. However, this method must be used with caution as pointed out by the authors. The chapter concludes with a brief discussion of the rainflow method and a number of other spectral type methods, i.e., those of Manson, Nachtigal and Freche, Corten, Dolan and Grover.

In summary, this is an excellent book. The reviewer believes that this book should be enlarged by expanding the section on random loading, high temperature fatigue, and corrosion fatigue of contact surfaces. The reviewer would have liked to see mention and application of finite element to crack propagation as well as stress concentrations of notched members. A table of nomenclature would be an asset to the book as well as the readers. The reviewer recommends this book to investigators dealing with fatigue study.

Mechanics of Elastic Structures. by J. T. Oden and E. A. Ripperger, McGraw-Hill, New York, 1981, 2nd edition, 486 pages. Price: $27.95

Reviewed by H. Saunders

This book is an updated version of a previous "best seller." This volume incorporates a number of topics which were not in the first edition. This book bridges the gap between elementary theory of strength of materials and the advanced subjects of structural analysis and structural mechanics. This new edition contains a number of new features and the mathematics can be digested with little difficulty. The book consists of 10 chapters.

Chapter 1 introduces the reader to what structural mechanics is about. Chapter 2 considers structural behavior. This includes forces and stresses in structural systems, stress resultants in bars, displacement and stresses in structural systems plus a vivid consideration of stress components. This chapter is a photocopy of the chapter of the first edition.

Chapter 3 treats the torsion of prismatic bars. This encompasses circular bars, noncircular bars, stress function by Prandtl for both thin-walled open sections and single-cell tubes. The chapter concludes with torsion of multicell thin-walled tubes plus an interesting description of finite difference method of a rectangular solid bar. This is a very "meaty" chapter.

Chapter 4 presents stresses and strain resultants in bars. The authors furnish the derivation of equilibrium equations and then proceed to normal stresses in curved bars, bending of symmetrical curved bars plus a number of illustrative examples. The reviewer had trouble in understanding equation (45) since it appears to be out of place. Again, it is a worthy chapter that one must read.

Chapter 5 discusses shearing stresses and shear flow in beams. Initiating this topic via integral equations, the authors continue on to shearing stresses in curved and unsymmetrical straight bars, stresses in beams of variable depth, shear lag and combined bending and torsion of multicell tubes. This chapter also is an exact reproduction of the first chapter in the first edition.

Chapter 6 becomes more interesting and examines the topic of elastic curve. Among the topics considered are deflections of a curved bar, alternative forms of the equations of the elastic curve, deflections of a symmetric curved and unsymmetric straight bar. The well known Bernoulli-Euler theory is expanded upon as well as the proper procedures of integrating the bar equation. This includes the Heaveside step function. The chapter concludes with deflection of ties and beam columns including the elastic foundation effects. The reviewer feels that shearing deformation applied to beams and columns should have been included.

Chapter 7 treats the bending and twisting of thin-walled beams. This is an "eye-opener" chapter and includes discussion on state of stress and strain in open sections plus beams which are restrained against warping. This makes the subject more complete. The authors include both warping shear and shear flow. The chapter concludes with the evaluation of twist of open sections and secondary warping constants of a tee and angle sections. The reviewer was disappointed that the authors deleted the section on the effect of axial loads on flexible thin-walled open sections. The more vigorous solution of including shearing strains for thin-walled open sections was also omitted.

Chapter 8 examines the principle of vertical work. This includes the virtual displacements of a particle, rigid and deformable bodies and displacements of simple structural systems. The authors explain the workings of the unit-dummy-displacement method with direct application to statically indeterminate structures. The principle of virtual forces forms the second part of this chapter. The authors delve into virtual forces and complementary virtual work and then derive the equilibrium equations. The chapter concludes with the application of the unit-dummy-load method statically indeterminate structures.

One of the mainstays of structural mechanics is energy principles. The authors introduce the topic by considering

potential energy and complementary energy via displacements. The principles of stationary potential and minimum potential energies are then considered. This includes stability analysis of simple structures and second variation in total potential energy. Progressing forward, we then encounter Rayleigh-Ritz method and Castigliano's first theorem with applications. This leads into the slope deflection equations, a welcome addition. This chapter wets our appetite by providing a short explanation of finite elements and concentrates on plane stress and triangular elements. We next meet the complementary energy principles. This includes Engesser's first theory and Castigliano's second theorem. A number of examples are provided. These include curved bars, plane trusses and nonlinear elastic beam. The chapter concludes with brief mention of Maxwell's theorem of reciprocity.

The concluding chapter describes bending of isotropic plates. The authors derive the well-known equilibrium equations. Simply-supported plates (4 sides) are treated and then the deflection equations are derived. The additional topics considered are full and annular plates with distributed loads and circular plates on elastic foundations. Naturally, numerical methods for rectangular plates must be furnished. The authors utilize the control difference scheme of finite differences plus a short treatment of finite elements.

In summary, this is an excellent book. The reviewer believes that the authors should have expanded the section on finite elements. The derivation of stiffness matrix of a beam would have enhanced the book. A few typographical errors were encountered but this should not distract the reader. This book should be on the shelf or desk of all designers and analysts interested in stress analysis.