basis of this limited usefulness of the second type of research that the first group has claimed the superiority of its own methods, although the latter have also been known to be ineffective when confronted with highly complex, but realistic design problems.

The current volume goes far toward establishing the practicality of the use of optimality conditions in the design of realistic structures. It is dedicated to Prof. William Prager, whose leadership and inspiration in the area of optimality research is unchallenged. Prager's example has been followed by a group of students, associates, and intellectual disciples, and the author is certainly one of the most prolific and productive within this group. It is altogether reasonable that he should be the one to compile the current volume, which is based to a considerable extent on his own work, although the work of others is freely discussed and generously acknowledged.

Flexural systems, that is, beams, slabs, etc., unlike discrete systems such as trusses, lend themselves to optimum design because of their continuity. Some discrete systems, such as grillages or fiber-reinforced slabs, may be treated as continua if the spacing of the elements is sufficiently close. For such systems there exists a substantial body of optimality conditions as well as their analytical or numerical solutions, and the current volume presents both a clear and comprehensive derivation of the theory and an up-to-date summary of available solutions. The author admits to a "definite bias toward . . . plastic design," but the problem of optimal elastic design is not neglected. Neither does the author neglect more recent developments (often his own), which include the cost of supports and the choice of location of these supports. Also, since fully optimally designed systems are often impractical for reasons of aesthetics or ease of fabrication, the subject of constrained optimization (that is, for example, the design of beams consisting of prismatic segments) is treated in full detail.

The first chapter covers basic concepts necessary for a study of optimality conditions, such as elements of variational calculus, definitions of convexity, general principles of mechanics, etc. Chapters 2–4 are devoted to optimal plastic design involving a single space variable (beams, rotationally symmetric plates, etc.) under single and multiple loads and for different levels of freedom of choice. Optimal elastic design is contained in Chapter 5. Genuine two-dimensional problems, notably grillages and fiber-reinforced plates, are covered in substantial detail in Chapters 6–8. In a sense such structures are equivalent to Michell trusses, and it is possible to establish general geometrical properties governing the spacing of the grillage beams or of the reinforcing fibers. However, unlike Michell trusses optimal grillages are entirely feasible, especially if optimization takes place under practical constraints. Upper and lower bound principles on optimal volumes facilitate the design even further. Chapter 9 finally discusses some practical design implications.

The book is written clearly and concisely. Important sections are often introduced by an excellent and comprehensive literature review giving a preview of salient results, which are then incorporated in the body of the section. Important equations and principles such as the Prager-Shield optimality criterion (on whose generalized form the author bases most of his developments) are set off in heavy print for easy reference, and special theoretical developments not essential to an understanding of the text are so identified. Some titles are somewhat convoluted ("partially prescribed cost distribution") and require an adjustment on the part of the reader, as do the figures which are too small for reading comfort. Conflicting theories and authors could have been refuted less elaborately if at all.

These are minor editorial criticisms, which are easily corrected in a second edition. All too often the search for strict optimality has been justified apologetically as a search for an ideal which, though impractical, can be used as a basis for comparison with more practical but imperfect designs. The current volume shows that for a broad class of problems the ideal and the practical can be combined. In the reviewer's opinion the book is therefore a landmark in the development of the theory and an indispensable tool in the hands of the designer.

Fracture of Brittle Solids. By B. R. Lawn and T. R. Wilshaw. Cambridge Solid State Science Series, Cambridge University Press. 1975. 204 Pages. $22.00 Clothbound. $10.95 Paperbound.

REVIEWED BY J. R. RICE[4]

This is a well-written introductory book which will appeal more to those interested in materials science than continuum and engineering aspects of fracture. The emphasis is on highly brittle solids such as ceramics and glasses and some metals. The presentation begins with the Griffith theory and with processes of crack nucleation, including dislocation models. This is followed by short presentations of elastic crack tip stress fields and essentials of Irwin's elastic fracture mechanics, of nonlinear fracture mechanics at the level of the J integral and Dugdale/BCS/Barenblatt models, and of dynamic fracture. It concludes with chapters on microstructural crack mechanisms in brittle materials and with two rather original chapters on discrete atomic lattice effects in fracture, including lattice trapping of cracks, and on kinetic processes of thermally activated, environmentally assisted slow crack growth in brittle materials, especially glasses. These latter sections may appeal also to more advanced workers in the subject.

The book does not develop theoretical topics at a fundamental enough level to serve as the only introduction of a serious student to the subject and no discussions of engineering fatigue and fracture analysis are presented. Also, the dynamic fracture section seems to rely on somewhat outdated work and an incorrect discussion is given of the energy release rates for crack branching. Nevertheless, the book is, when judged overall, very successful within the authors' chosen level and purview. It would, I believe, be excellent textbook material for coverage of fracture as part of an upper level undergraduate or perhaps beginning graduate materials science course on mechanical properties. Also, it would be very useful as supplementary reading for students of more mechanics and engineering centered courses on fracture. Its price in paperback form is refreshingly affordable: $10.95 in the United States, $7 or so at current conversion rates in the United Kingdom.

Classical Dynamics. By Donald T. Greenwood. Prentice Hall, Englewood Cliffs, N.J. 1977. Pages 337. Price $18.95.

REVIEWED BY R. M. ROSENBERG[5]

This book was written as a text in an advanced dynamics course taught in the University of Michigan.

The fundamental concepts of dynamics and a brief treatment of generalized coordinates, of constraints, and of virtual displacement and virtual work are presented in the first chapter. The next two chapters deal with Lagrangian mechanics including a derivation of Lagrange's equations, a section on integration theory and applications (to small oscillations, to forces derivable from a Rayleigh function, to impulsive forces and constraints, to gyroscopic forces, and to velocity-dependent potentials).

There follow three chapters on Hamiltonian mechanics beginning with a brief treatment of the variational fixed-endpoint problem in one and many dependent variables, Hamilton's principle for holonomic and nonholonomic problems, the theory of contemporaneous and noncontemporaneous variations, and a derivation of the canonical equations. The next chapter contains the Hamilton-Jacobi theory and the separability theorems of Liouville and Stäckel. The final chapter on Hamiltonian mechanics contains the theory of canonical transformations and introduces the Poisson and Lagrange brackets, in-

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