Journal of Applied Mechanics

Book Reviews

Dynamic Stability of Suddenly Loaded Structures, by George J. Simitses. Springer-Verlag, New York, 1990. 290 pages.

REVIEWED BY R. H. PLAUT[1]

Until recently, there has been a dearth of books on the stability of structures subjected to suddenly applied loads. Happily, this situation is being remedied. Two recent books, *Dynamic Pulse Buckling* by H. E. Lindberg and A. L. Florence, and *Structural Impact* by N. Jones, concentrate on the elastic and plastic response of structures to intense loads of very short duration. They are complemented nicely by this new book written by Prof. G. J. Simitses.

Simitses considers conservative elastic systems subjected to impulse loads, step loads (i.e., suddenly applied loads with constant magnitude and infinite duration), and rectangular pulse loads (i.e., suddenly applied loads with constant magnitude and finite duration). Dynamic instability here means that the system exhibits a large-amplitude response. Throughout the book, critical values of the dynamic loads are compared to those for the case of quasi-static loading.

A "total potential energy approach" is applied, which has been developed by Simitses. (A similar method, used by C. S. Hsu and his collaborators, is also described in the book.) The energy imparted to the system by the dynamic load is compared to the potential energy of the system at all unstable equilibrium points. One can then determine lower and upper bounds on the critical loads. For one degree-of-freedom systems, these bounds are identical and exact critical loads are obtained.

Following an introductory chapter, three simple rigid-bar models are treated in Chapters 2–4. Two of them have one degree-of-freedom, while the third is a snap-through model with two degrees-of-freedom. The effect of static preloading is analyzed, and some problems are given at the ends of these chapters. For the case of rectangular pulse loading, the influence of small viscous damping is discussed in an appendix.

In Chapter 5, the application of the energy approach to continuous elastic systems is described. Impulse and step loads are considered. Simple two-bar frames are treated in Chapter 6. A step load is applied and lower bounds are obtained for various boundary conditions, eccentricities, and slenderness ratios.

Chapter 7 deals with shallow arches having a half-sine-wave initial shape. The first example is a pinned arch with the load distributed spatially in a half sine wave. Lower and upper bounds are computed for impulse, step, and rectangular pulse loads. In the second example, a clamped arch is subjected to a concentrated load at its apex, applied as an impulse or step load. The response is represented approximately as a combination of two symmetric modes and one antisymmetric mode.

Thin, shallow, clamped, spherical caps under uniform lateral pressure are treated in Chapter 8. Axiymmetric deformations are considered. Lower bounds for a two-term approximation are determined for the cases of impulse and step loading. In Chapter 9, thin cylindrical shells are analyzed. Laminated shells and stiffened shells are included, with geometric imperfections and various boundary conditions. An approximation procedure is utilized, and lower bounds on critical conditions are computed for axial step loading. Finally, conditions based on a prescribed maximum response amplitude are discussed in Chapter 10, and parametric resonance and brachistochrone problems are described in the appendices.

This book is a welcome addition in the field of structural stability. It presents an energy approach which can be used to obtain bounds on critical conditions for suddenly loaded elastic structures. The book is written clearly and covers the basic work carried out by Simitses in this area. It may be used as a textbook for part of a graduate course on dynamic stability of structures, and should be read by researchers in this field.

Introduction to Optimization of Structures, by N. V. Banichuk. Springer-Verlag, New York, 1990. 300 pages. Price: $89.00.

REVIEWED BY BHSHAN L. KARIHALOO[2]

Introduction to Optimization of Structures by Professor N. V. Banichuk is a translation of the original Russian book of the same name, published in 1986. The book is divided into two parts: Part 1 gives an introduction to the theory and techniques of optimization, whereas Part 2 demonstrates the application of theoretical concepts on several examples of beams, plates, shells, trusses, etc.

Chapter 1 gives a general overview of the optimization problem under statical and dynamical conditions, introducing the necessary objective and constraint functionals. This chapter also introduces the reader to multipurpose and multicriteria design problems. Chapters 2 and 3 give the derivation of optimality conditions using classical variational calculus. Chapters 4 and 5 are devoted to the solution of the optimization problems using several analytical and numerical approaches.

Chapters 6–8, which form Part 2 of the book, apply the optimization concepts to beams, plates, shells, trusses, etc. with a view to designing these structures, such that they use the least amount of material in fulfilling their mechanical function.

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