Book Review

Variational Methods in Elasticity and Plasticity, by Kyuichiro Washizu, 3rd Ed., Pergamon Press, New York, 1982, 630 pp., list price $100.00

Variational Methods in Elasticity and Plasticity is in its third edition. The first edition was timely, because it coincided with a period of rapid growth in the application of finite element methods. The second edition added a new Appendix I introducing an outline of variational principles that are frequently used as a basis for mathematical formulations in elasticity and plasticity, including those new variational principles developed in connection with the finite element method. This third edition is divided into two parts: Part A, except for a few new topics, is almost the same as the first edition; Part B, entitled "Variational Principles as a Basis of the Finite Element Method," provides an improved presentation of Appendix I of the second edition. It includes conventional variational principles, as well as modified variational principles with relaxed continuity requirements, for small and finite displacement theories of elastostatics, elastodynamics, two incremental theories of geometrical and material nonlinearities, and bending of plates. The last chapter discusses discrete analysis, with an additional introduction to the boundary element method.

One of the main features of the third edition is the repletion of Appendices, in which several new topics have been introduced: variational principles in the dynamics of a system of particles, strain complementary energy functions, stress tensors in finite displacement theory, and the boundary element method.

The first five chapters of Part A treat the formulation of variational principles in elasticity, including a concise summary of the small displacement theory of elasticity in rectangular Cartesian coordinates, variational principles in the small and finite displacement theories, extensions of the principle of virtual work and related variational principles, and the theory of elasticity in curvilinear coordinates. Chapters 6-10 present technical structural problems of the torsion of bars, beams, plates, shells, and structures. Exercises and references are listed at the end of each chapter. The exercises verify and extend the text material.

Chapters 11 and 12 summarize the deformation and flow theories of plasticity, respectively.

In Part B, Chapters 13-15 parallel the treatment of Chapters 1-3 and 5, but from the viewpoint of finite element formulations. The subjects covered are conventional and modified variational principles in the small finite displacement theories of elastostatics and in elastodynamics.

The last three chapters deal with two incremental theories for a solid-body problem with geometrical and material nonlinearities, principles of the bending of elastic plates, and discrete analysis.

The book is intended for advanced engineering students. The reviewer believes that this should mean graduate students who have had basic course work in elasticity, plasticity, and finite element methods. Some knowledge of the calculus of variations is also needed. The book should serve as an excellent reference for anyone working in the field of elasticity.

Professor Washizu should be complimented on an excellent presentation of his subject matter and this reviewer highly recommends the book to graduate students, teachers, university researchers, and professionals alike.

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