# Book Review

## *Virtual Principles in Aircraft Structures*

B. E. Gatewood, Kluwer Academic Publishers, Dordrecht, The Netherlands, 1989, Vol. 1, 333 pp. and Vol. 2, 362 pp., $245.00.

This two-volume work is in effect a treatise on almost the whole field of aircraft structures. The first volume would be appropriate for undergraduate aircraft structures courses, while the second volume considers more practical as well as more advanced topics. Thus, the book should be of interest to both students and practitioners in aircraft structures.

Chapter 1 of Volume 1 presents various formulations of the fundamental equations of structural analysis and their application to thin-web beams. This chapter also covers inelasticity and thermal effects. Chapter 2 is devoted to the three fundamental virtual principles: virtual displacements, virtual forces, and mixed virtual forces and virtual displacements. In Chapters 3, 4, and 5, the virtual principles are applied to pin-jointed trusses, simple beams, and box beams, respectively. Chapter 6 constitutes a rather extensive treatment of the shear-lag phenomenon in stringer-reinforced thin shear webs. Volume 1 concludes with appendices on matrix algebra, flight vehicle loads, and derivation of the strain energy theorems from the virtual principles.

In Volume 2, Chapter 1 is devoted to allowable stresses, including temperature and creep effects and fatigue. Chapter 2 deals with both analysis and design of joints (mechanical, welded, and bonded). Chapter 3 treats the design of structural components, including columns, stiffened panels, and box beams. Chapter 4 covers pressurized structures, including membrane stresses, axisymmetric bending, bending due to stringers and frames, bending of noncircular vessels, and buckling of pressure-stabilized structures. Chapter 5 is concerned with approximate solutions for tapered beams and columns using the virtual principles. Chapter 6 presents the dynamic analysis of simple beams, including free and forced vibration and wing flutter. Chapter 7 treats the classical analysis of thin, isotropic rectangular plates, including small and large deflections, buckling, and free vibration. Chapter 8 discusses both rectangular and triangular finite elements for plate bending, while Chapter 9 introduces matrix structural analysis using beam elements. The book is concluded with a chapter that consists of a brief introduction to composite materials.

To facilitate learning, most of the chapters contain exercises. To aid those desiring to dig deeper into the subject, each chapter is concluded with a list of pertinent references.

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