

Aeroservoelasticity

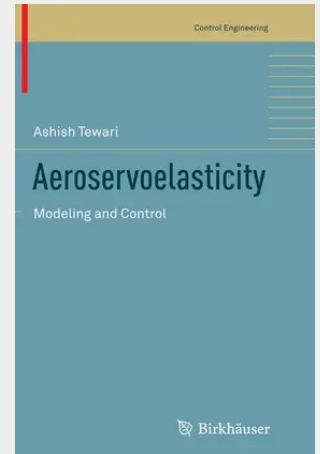
Modeling and Control

This monograph presents the state of the art in aeroservoelastic (ASE) modeling and analysis and develops a systematic theoretical and computational framework for use by researchers and practicing engineers. It is the first book to focus on the mathematical modeling of structural dynamics, unsteady aerodynamics, and control systems to evolve a generic procedure to be applied for ASE synthesis. Existing robust, nonlinear, and adaptive control methodology is applied and extended to some interesting ASE problems, such as transonic flutter and buffet, post-stall buffet and maneuvers, and flapping flexible wing.

The author derives a general aeroservoelastic plant via the finite-element structural dynamic model, unsteady aerodynamic models for various regimes in the frequency domain, and the associated state-space model by rational function approximations. For more advanced models, the full-potential, Euler, and Navier-Stokes methods for treating transonic and separated flows are also briefly addressed. Essential ASE controller design and analysis techniques are introduced to the reader, and an introduction to robust control-law design methods of LQG/LTR and H_2/H_∞ synthesis is followed by a brief coverage of nonlinear control techniques of describing functions and Lyapunov functions. Practical and realistic aeroservoelastic application examples derived from actual experiments are included throughout.

Aeroservoelasticity fills an important gap in the aerospace engineering literature and will be a valuable guide for graduate students and advanced researchers in aerospace engineering, as well as professional engineers, technicians, and test pilots in the aircraft industry and laboratories.

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