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Flutter Analysis of Subsonic Wing

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In this paper, a procedure is developed based on Galerkin method to predict the speed and frequency in which flutter occurs. The finite element structural model used for the wing is a three-DOF cantilever beam, in which one coordinate is related to the vertical displacement and the other two are corresponding to bending and rotation. This beam element has Hermit-cubic-type in bending and linear in rotation characteristics. Consequently, an eigenvalue problem with non-symmetric matrix coefficients was derived. It was found that as free stream velocity increases from zero up to 0.554 Mach (for incompressible flow) and 0.526 Mach (for compressible flow), the real parts of the eigenvalues have negative signs and the system become stable. Further increasing of free-stream velocity causes the amplitude of the frequencies approach zero and become positive, which indicates dynamic instability, or flutter of the system.

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