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COMPARISON OF TWO SHOCK-CAPTURING METHODS FOR CALCULATION OF TRANSONIC AIRFOIL FLUTTER

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The flutter of a pitch-and-plunge airfoil (PAPA) in transonic flow is simulated using two shock-capturing methods. Each method solves a coupled system of equations involving the unsteady Euler equations and a two-degree-of-freedom structural model. The first method, TVDntiAE, uses an explicit Total-Variation-Diminishing (TVD) algorithm to compute the flowfield for a 2-D airfoil. The second method, ENS3DAE, uses an implicit Beam-Warming approach to compute the flowfield on a 3-D rectangular wing while enforcing 2-D flow. Results of the schemes are compared with each other and against limited published data to extend the validation of the software to unsteady fluid/structure interactions. Results are compared for three airfoil configurations: (1) static; (2) forced oscillation; and (3) PAPA. Computation of flutter points is of special interest. ENS3DAE predicts a flutter onset speed for the NACA 64A-006 airfoil at M_∞=0.87 that is 1% greater than the value predicted by TVDntiAE and is 2% smaller than the published data. Variations in model predictions due to dissipation-model differences and grid and time-step sensitivities are evaluated.

limit cycle, flutter, LCO, NACA 0012, NACA 64A006, CFD, TVD Beam-Warming, ENS3DAE, TVDntiAE

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