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Linear Stability Analysis on Multiple Solutions of Steady Transonic Small Disturbance Equation YA LIU[1], FENG LIU[2], SHIJUN LUO[3], Department of Mechanical and Aerospace Engineering, University of California, Irvine, CA 92697-3975 — Multiple solutions of the steady Transonic Small Disturbance (TSD) potential equation occur within a narrow range of freestream Mach number. Three numerical solutions for the NACA 0012 airfoil at freestream Mach number 0.85 and zero angle of attack are computed using the conservative Murman-Cole scheme. One solution is symmetric and the other two are asymmetric and mirror-images of each other. The linear stability of the numerical solutions are analyzed by an eigenvalue technique. The Jacobi matrix is constructed from the discrete steady TSD equation and evaluated with the converged numerical solution. The maximum real part of the eigenvalues for the symmetric solution is positive (0.7×10^{-2}) and that for the asymmetric solution is negative (-0.8×10^{-2}) indicating that the symmetric solution is unstable and the two asymmetric solutions are stable under small perturbations. These stability conclusions are verified by numerical computations.

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