

Solution of the transonic integrodifferential equation using a decay function

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Abstract:

The two-dimensional, small-disturbance, transonic integrodifferential equation is solved by using a decay function that is applicable in the entire computational domain rather than on the airfoil surface only. The computational domain is discretized into rectangular elements, and the integrals involving the dependent variable and its derivatives are approximated by boundary element methods in each rectangle. Besides constant elements, use is made of hybrid elements that are based on constant elements in the streamwise direction and variable elements in the transverse direction. The methods are tested for parabolic-arc and NACA0012 airfoils in nonlifting subcritical and supercritical flows. The results compare favorably with finite difference solutions. It is found that even with only one vertical level of rectangular elements, and hence a relatively small number of nodes, the accuracy is still good.