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Active Control of Shock/Boundary Layer Interaction in Transonic Flow Over Airfoils

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The objective of this paper is to show, via numerical simulation, the feasibility of weakening the shock wave(s) and reducing the pockets of supersonic and separated flow regions on airfoils in transonic flow at small angles of attack using an active control device such as a synthetic jet or a spark-jet actuator. A large number of numerical simulations are performed for transonic turbulent flow past a NACA 0012 airfoil and a Boeing 767 airfoil at small angles of attack (cruise flight condition) by varying various parameters of the synthetic jet such as amplitude of the jet velocity, jet width, momentum coefficient, frequency, and jet location on the airfoil surface. Detached Eddy Simulation(DES)modification of Menter's two-equation Shear Stress Transport(SST)model is employed in the computations.It is shown that the maximum value of the Mach number in the supersonic region decreases resulting in reduced drag with minimal change in lift for suitably selected parameters of the synthetic jet.

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