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Modeling of tangential synthetic jet actuators used for pitching control on an airfoil[1] OMAR LOPEZ, ROBERT MOSER, University of Texas at Austin — Pitching moment control in an airfoil can be achieved by trapping concentrations of vorticity close to the trailing edge. Experimental work has shown that synthetic jet actuators can be used to manipulate and control this trapped vorticity. Two different approaches are used to model the action of tangential-blowing synthetic jet actuators mounted near the trailing edge of the airfoil: a detailed model and Reynolds stress synthetic jet (RSSJ) model. The detailed model resolves the synthetic jet dynamics in time while the RSSJ model tries to capture the major effects of the synthetic jet by modeling the changes in the Reynolds stress induced by the actuator, based on experimental PIV data and numerical results from the detailed model. Both models along with the CFD computations in which they are embedded are validated against experimental data. The synthetic jet models have been developed to simulate closed loop flow control of the pitching and plunging of the airfoil, and to this end the RSSJ model is particularly useful since it reduces (by an order of magnitude) the cost of simulating the long-term evolution of the system under control.

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