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Receptivity of high-speed boundary layers with real gas effects[1]

JILL KLENTZMAN, ANATOLI TUMIN, University of Arizona — The receptivity of high speed boundary layers in chemical nonequilibrium is investigated. A method is developed for the multi-mode decomposition of boundary layer flows including real gas effects, and the receptivity problem with small disturbances introduced at the wall is examined. The solution of the linearized Navier-Stokes equations, within the parallel flow approximation, is expressed in the form of normal modes, and the resulting differential equations for the amplitude functions are discretized using fourth-order finite differences. This discretized system is then in the form of a generalized eigenvalue problem, which yields a straight-forward definition of the associated adjoint system. A biorthogonality condition is formulated based on the adjoint eigenvectors. Assuming that a complete system of eigenfunctions of the discrete and continuous spectra exists, the biorthogonality condition allows for the projection of a solution onto the discrete modes, which can be utilized in the analysis of DNS results.

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