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Inviscid Stability Analysis of Chemically Reacting Boundary Layers in Binary Gas Mixtures[1] JILL KLENTZMAN, ERMAN ULKER, ANATOLI TUMIN, University of Arizona — The inviscid stability of boundary layers in binary mixtures of nitrogen and oxygen in thermal equilibrium is investigated. Both temporal and spatial frameworks are considered. With the assumption of inviscid flow, the simplicity of the governing equations allows for a clear, direct comparison between the structure of the eigenvalue spectrums of real and perfect gases. Our results indicate that qualitatively the eigenvalue spectrum of a real gas should be similar to that of a perfect gas. When we examine the impact of real gas effects on the first and second modes, we find that real gas effects act to stabilize the first and destabilize the second. This can be attributed to the decrease in temperature at the solid surface due to variations in the specific heat. If we isolate the real gas effect of changes in species concentrations due to chemical reactions, we find that this effect alone stabilizes the second mode, which agrees with studies of flows at finite Reynolds number. This could be the result of energy being absorbed and used for dissociation rather than for the growth of disturbances.

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Jill Klentzman
University of Arizona

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