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Receptivity to Kinetic Fluctuations: A Multiple Scales Approach[1] LUKE EDWARDS, ANATOLI TUMIN, The University of Arizona — The receptivity of high-speed compressible boundary layers to kinetic fluctuations (KF) is considered within the framework of fluctuating hydrodynamics. The formulation is based on the idea that KF-induced dissipative fluxes may lead to the generation of unstable modes in the boundary layer. Fedorov and Tumin (AIAA J., 2017) solved the receptivity problem using an asymptotic matching approach which utilized a resonant inner solution in the vicinity of the generation point of the second Mack mode. Here we take a slightly more general approach based on a multiple scales WKB ansatz which requires fewer assumptions about the behavior of the stability spectrum. The approach is modeled after the one taken by Luchini (AIAA J., 2016) to study low speed incompressible boundary layers over a swept wing. The new framework is used to study examples of high-enthalpy, flat plate boundary layers (see Edwards Tumin, AIAA 2017) whose spectra exhibit nuanced behavior near the generation point, such as first mode instabilities and near-neutral evolution over moderate length scales. The configurations considered exhibit supersonic unstable second Mack modes despite the temperature ratio $T_w/T_e > 1$, contrary to prior expectations.

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