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DNS and theoretical study of perturbations in a hypersonic boundary layer over a flat plate XIAOWEN WANG, UCLA, ANATOLI TUMIN, University of Arizona, XIAOLIN ZHONG, UCLA — Direct numerical simulation of receptivity in a boundary layer over a flat plate was carried out with perturbations introduced into the flow by periodic-in-time blowing-suction through a slot. The free stream Mach number is equal to 5.92. The perturbation flow field was decomposed into normal modes with the help of the multimode decomposition technique based on the spatial biorthogonal eigenfunction system. The decomposition allows filtering out the unstable mode hidden behind perturbations having another physical nature. The development of the filtered-out unstable mode is compared with a theoretical prediction based on the method of multiple scales that includes the nonparallel flow effects. The results illustrate how the multimode decomposition technique may serve as an efficient tool for gaining insight into the flow dynamics in the presence of perturbations belonging to different modes.

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