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Hypersonic boundary layer transition over curved-walls: A mechanism based on Gorlter vortices[1] ANUBHAV DWIVEDI, University of Minnesota, GS SIDHARTH, Los Alamos National Lab, GRAHAM V CANDLER, University of Minnesota, MIHAILO R JOVANOVIC, University of Southern California
— We investigate amplification of small disturbances in compressible boundary layers on a flat plate with a concave flare. To understand mechanisms that trigger the transition in the boundary layer flow over a curved wall, we utilize input-output analysis to quantify the receptivity of flow fluctuations to exogenous disturbances. Our analysis identifies Gorlter vortices as the most amplified flow structures and provides insights into mechanisms that select the dominant spanwise wavelength. The effect of wall heat transfer on the growth of boundary layer perturbations is also explored. Furthermore, we complement the input-output analysis with direct numerical simulations to investigate the non-linear stages of the disturbance evolution. Since Gorlter vortices are often responsible for boundary layer transition on curved walls, methods to attenuate early stages of their amplification are also analyzed and their effectiveness is discussed.

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