Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Stability of laminar supersonic flow on compression ramps NICOLAS CERULUS, University of Liverpool, RICARDO DOS SANTOS, Universidade Federal Fluminense, HELIO QUINTANILHA, University of Liverpool, LEONARDO ALVES, Universidade Federal Fluminense, VASSILIS THEOFILIS, University of Liverpool, UNIVERSIDADE FEDERAL FLUMINENSE COLLABORATION, UNIVERSITY OF LIVERPOOL COLLABORATION — Flow characterized by separation linked to interacting shock systems and boundary layers on compression ramps has been the object of continuous research for decades, aiming at accurately predicting heat transfer through vehicle surfaces operating in this flow regime. A ubiquitous feature observed in laminar flows calculated by standard 2nd-order accurate schemes is the presence of small amplitude oscillations in the flowfield, which hinders obtaining true time independent solutions for the subsequent linear stability analysis. A recently developed high-order numerical method provides machine-precision time-independent base states, without these oscillations. Steady laminar basic flows were analyzed regarding their global modal and non-modal linear stability using the state-of-the-art LiGHT solver to solve the respective EVP and SVD problems. Results showed the importance of the separation region and recompression shock in the flows stability, as well as the connection of these regions through the global mode amplitude functions. Non-modal analysis revealed a significant transient growth at short time leading to the conjecture that such growth may be significant enough to cause by-passing the modal transition path.

nicolas cerulus
University of Liverpool

Date submitted: 03 Aug 2020 Electronic form version 1.4