Effects of passive porous walls on hypersonic boundary layers[1]

SHARON STEPHEN, VIPIN MICHAEL, University of Birmingham — We consider the effect of a passive porous wall on the first mode of a hypersonic boundary layer on a sharp slender cone. A theoretical stability analysis is used for large Mach number and large Reynolds number which includes the effect of curvature and of the attached shock. The formulation considers the scales appropriate to the first mode which is associated with Tollmien- Schlichting waves and this results in a triple-deck structure. The flow in the hypersonic boundary layer is coupled to the flow in the porous layer. We consider the porous layer on the cone surface to be a sheet perforated with cylindrical blind holes of equal spacing[2]. The linear stability analysis results in an eigenrelation, relating the streamwise wavenumber and the frequency of the disturbances. Neutral solutions will be presented, indicating a destabilizing efect of the porous wall. Spatial growth rates obtained will demonstrate that the porous wall leads to a significant increase in disturbance growth rates. In addition, the effect of nonlinearity is considered.

[2]Fedorov, A. V., Malmuth, N. D., Rasheed, A. and Hornung, H. G. *AIAA J.* **39**, 605 (2001).

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