DSRC Event

Department Student Research Seminar

Linear Stability Analysis of Compressible Channel Flows

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ABSTRACT

Fluids flows often become unstable to infinitesimal perturbations for a certain range of values of the governing parameters such as Reynolds number. Compared to unstable incompressible flows, the instability characteristics become significantly different in nature when the mean flow velocity is comparable to the speed of sound. In this talk, the modal stability characteristics of a compressible flow in a 2D plane channel will be discussed. We will begin with the numerical results obtained for the unstable solutions of the compressible viscous stability equations. The observations indicate that these instabilities occur when the inertial effects are dominant in the flow while the viscous effects are confined to thin layers close to the walls. We, therefore, analyze the compressible stability equations in the asymptotic limit of Re going to infinity, in an effort to explain some of the numerical observations. In particular, our focus will be on understanding the nature of the compressible counterpart of the Tollmien-Schlichting instability, and the first of the higher mode instabilities (Mode II) observed in the compressible plane shear flows.

ABOUT THE SPEAKER

Mandeep Deka is a PhD student from Mechanical Engineering Department, IISc, currently working in linear stability of compressible flows. He completed his B.Tech. in Mechanical Engineering from National Institute of Technology (NIT), Silchar in 2015. Following that he completed his Master's in 2017 from Indian Institute of Technology, Guwahati (IITG) from Mechanical Engineering Department with specialisation in Fluid and Thermal Engineering. His masters work focused towards developing balanced-force algorithms for incompressible flows and gradient reconstruction schemes in unstructured finite volume method. His current research interests are broadly in area of fluid mechanics with focus on the dynamics of high Ma number flows and also in developing efficient numerical algorithms for fluid flows.

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