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Effect of Prandtl number on the linear stability of compressible Couette flow KRISHNENDU SINHA, ASHWIN RAMACHANDRAN, BIJAYLAKSHMI SAIKIA, Department of Aerospace Engineering, IIT Bombay, RAMA GOVINDARAJAN, TIFR Centre for Interdisciplinary Sciences, Hyderabad — Accurate prediction of laminar to turbulent transition in high speed flows is a challenging task. Compressibility, and the resultant large variations in transport properties can affect this transition significantly. Prandtl number (ratio of momentum and thermal diffusivities) is an important parameter which affects the linear stability of high Mach number wall-bounded flows. A two-dimensional compressible plane Couette flow having uniform viscosity and thermal conductivity with varying Prandtl numbers is our model problem. A temporal stability analysis shows that the variation of phase speed with Prandtl number leads to synchronization between acoustic modes, with peaks in growth rate at the synchronization points. Two types of branching patterns are observed, depending on the Prandtl number. The stability diagrams for varying Mach and Reynolds numbers show a destabilizing role of decreasing Prandtl number, both in terms of increased disturbance growth rates, and of larger regions of instability in the parameter space. It also results in a significant reduction in the critical Reynolds number of the flow, especially at high Mach numbers.

Krishnendu Sinha
Department of Aerospace Engineering, IIT Bombay

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