Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Direct numerical simulation of K-type and H-type transitions to turbulence in a low Mach number flat plate boundary layer[1] TARANEH SAYADI, CURTIS HAMMAN, PARVIZ MOIN, Center for Turbulence Research (CTR), Stanford University — Transition to turbulence via spatially evolving secondary instabilities in compressible, zero-pressure-gradient flat plate boundary layers is numerically simulated for both the Klebanoff K-type and Herbert H-type disturbances. The objective of this work is to evaluate the universality of the breakdown process between different routes through transition in wall-bounded shear flows. Each localized linear disturbance is amplified through weak non-linear instability that grows into lambda-vortices and then hairpin-shaped eddies with harmonic wavelength, which become less organized in the late-transitional regime once a fully populated spanwise turbulent energy spectrum is established. For the H-type transition, the computational domain extends from $Re_x = 10^5$, where laminar blowing and suction excites the most unstable fundamental and a pair of oblique waves, to fully turbulent stage at $Re_x = 10.6 \times 10^5$. The computational domain for the K-type transition extends to $Re_x = 9.6 \times 10^5$. The computational algorithm employs fourth-order central differences with non-reflective numerical sponges along the external boundaries. For each case, the Mach number is 0.2.

[1]Supported by the PSAAP program of DoE, ANL and LLNL.

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Date submitted: 30 Jul 2011 Electronic form version 1.4