Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Numerical Study of Broadband Disturbance Development in APG Boundary Layer Flow[1] WEIJIA CHEN, JIM CHEN, EDMOND LO, Nanyang Technological University — A numerical model is developed with combined compact difference methods to simulation boundary layer transition problems. The model is used to investigate the formation and development of coherent structures in late stage of a laminar-turbulent transition initiated by a two-dimensional Tollmien-Schlichting (TS) wave and initially weak broadband disturbances. The numerical simulation closely follows the conditions in the experiments by Borodulin (2006). The boundary layer base flow has an Adverse Pressure Gradient (APG) with Hartree parameter $\beta_{\mathrm{H}} = -0.115$. The instantaneous flow structures are visualized, which demonstrate results comparable with experiments. Interaction between the TS wave and broadband disturbances leads to the formation of Λ-vortices, Ω-vortices, and ring-like vortices. In comparison with those in classical transition paths, i.e., fundamental and subharmonic resonances, these structures are distributed in a random order and have distorted shapes. However, their local evolution properties are qualitatively similar with those in classical transition paths.

[1]The authors thank Nanyang Techonological Univerisity for funding support.

Suchun Li
National University of Singapore

Date submitted: 08 Jan 2014 Electronic form version 1.4