Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Nonlinear spatial marching of high-amplitude perturbations[1]

SHAUN R. HARRIS, M. J. PHILIPP HACK, Center for Turbulence Research, Stanford University — The physics of bypass transition are closely related to the formation of highly energetic streaks within the boundary layer. Owing to the high amplitudes of the streaks, nonlinear interactions and the generation of harmonics play an important role in their development, as well as in triggering their secondary instability. The high amplitudes attained by the streaks also pose unique challenges for their computational modeling. While the nonlinear parabolized stability equations have been shown to accurately describe the exponential amplification of disturbances in classical transition scenarios, they inadequately capture the formation of streaks and the associated generation of perturbation harmonics. In this talk, we present a novel framework for the nonlinear spatial marching of high-amplitude perturbations. In comparisons with direct numerical simulations, we demonstrate the accuracy of the approach in predicting the growth of high-amplitude streaks. The computational cost of the method is comparable to that of the established nonlinear parabolized stability equations.

[1]This research is supported by Sandia National Laboratories.

Shaun R. Harris
Center for Turbulence Research, Stanford University

Date submitted: 23 Jul 2019 Electronic form version 1.4