Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Numerical simulations of two-fluid boundary layers beneath free-stream turbulence SEO YOON JUNG, TAMER ZAKI, Imperial College London — In two-fluid boundary layers, a wall-film is sheared by an external stream with different density and viscosity. As a result, the flow becomes prone to both shear and interfacial instabilities. In this study, the evolution of two-fluid boundary layers beneath free-stream vortical forcing is investigated using DNS. The simulations employ a conservative level-set technique in conjunction with a ghost fluid approach in order to capture a sharp interface. The wall film is less viscous than the outer flow, and its thickness is 10% of that of the boundary layer at the inlet. The choice of viscosity ratio influences the spatial development of disturbances within the boundary layer. The spatial growth of instabilities is examined into the non-linear regime, which includes the region of breakdown to turbulence. We demonstrate that, at moderate levels of free-stream turbulence intensities, appropriate choice of the viscosity ratio can yield considerable transition delay.

Tamer Zaki
Imperial College London

Date submitted: 05 Aug 2011 Electronic form version 1.4