Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Viscous-Inviscid Interaction Analysis in High-Reynolds Number Flows Using Complex Singularities K.W. CASSEL, Illinois Institute of Technology, F. GARGANO, M. SAMMARTINO, V. SCIACCA, University of Palermo — Interaction between the viscous boundary layer and inviscid outer flow occurs during unsteady separation on two distinct spatial scales depending upon the Reynolds number regime. Using the impulsively-started flow about a circular cylinder, it is illustrated how these regimes can be identified by tracking singularities in the complex plane based on numerical solutions of the unsteady Navier-Stokes equations. Such an analysis also allows for clear identification in Navier-Stokes solutions of the precursor to the van Dommelen singularity, which occurs in the classical non-interactive boundary-layer equations. The first interaction developing in the separation process is large-scale interaction that is visible for all the Reynolds numbers considered, and it signals the first relevant differences between the boundary-layer and Navier-Stokes solutions. For $Re \geq O(10^4)$, a small-scale interaction corresponding to the van Dommelen singularity follows the large-scale interaction.

Kevin Cassel
Illinois Institute of Technology

Date submitted: 02 Aug 2013 Electronic form version 1.4