Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

Non-modal stability analysis of viscous confined two-dimensional jets and wakes with finite shear GARY CHANDLER, COLM CAULFIELD, MATTHEW JUNIPER, University of Cambridge — Non-modal techniques have become increasingly popular for the investigation of simple flows in order to gain useful insight into their transient behavior. Using a linearized perturbation version of the Navier-Stokes equation within a spectral DNS solver, this study investigates the transient growth rate for confined and unconfined 2D viscous jets and wakes. A range of finite times were selected and the time-averaged maximum optimized energy growth rates for a a range of wave numbers were calculated and compared to the growth rate of the least stable eigenmode. The optimized initial conditions were found and used in full non-linear calculations to gain insight into the effect of the optimized initial conditions on stimulating non-linear flow regimes. Variable finite shear is included by superimposing two tanh profiles and its effect on the stability of the flow is also studied. The techniques used in this investigation can be extended to 3D flows with complex geometries, thus enabling the study of more realistic flows and eventually optimization for high transient growth rates in fuel injection processes.

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Date submitted: 02 Aug 2007 Electronic form version 1.4