Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Generalized energies for the stability analysis of plane Pouiseuille flow MARIA-VITTORIA SALVETTI, University of Pisa, ANDREA NERLI, Scuola Normale Superiore di Pisa, SIMONE CAMARRI, University of Pisa — Classical energetic stability theory fails in the case of plane Pouiseuille flow, leading to a severe underestimation of the critical Reynolds number, since the linearized Navier-Stokes operator is highly non-normal even for moderate Reynolds numbers. Moreover, the non-linear term contribution vanishes, and thus information about the amplitude of critical disturbances is lost. In the present work a procedure is proposed to derive generalized energies to be used in the energetic stability analysis. In particular, it is shown that the classical energy functional can be perturbed, depending on the Reynolds number, in order to bypass the problems related to the non-normality of the operator. When the generalized energies are used instead of the kinetic energy, the non-linear convective term is shown to play a role, and, for each considered Reynolds number, a lower bound for the amplitude of disturbances that may lead to transition is estimated. The proposed generalized energies are described, and results of their application to plane Pouiseuille flow are shown.

Maria-Vittoria Salvetti
University of Pisa

Date submitted: 28 Jul 2005 Electronic form version 1.4