

# *The Eigenvalues of Some Stability Problems Involving Viscosity\**

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**1. Introduction.** Small disturbances of the form  $\phi(y)e^{i\alpha(x-ct)}$  are assumed to occur in a viscous flow (1) between moving walls, (2) with a symmetrical velocity profile between two fixed walls and (3) in a boundary layer along a flat plate. Corresponding to each problem for the viscous fluid, there is a simpler problem with viscosity zero. It is natural to conjecture that, for large Reynolds numbers, the eigenvalues in the complete viscous problem are related to those in the corresponding inviscid problem. The present investigation justifies the relationship between inviscid and viscous eigenvalues in most cases and in fact expresses these viscous eigenvalues asymptotically with respect to the Reynolds number in terms of the inviscid eigenvalues.

However, in the case of Couette flow, it is known that the inviscid problem has no solution, and yet physical considerations indicate that the viscous problem should at least possess damped solutions. The existence of viscous solutions unrelated to inviscid solutions is confirmed and some of their properties are determined.

We consider cases where the following conditions hold:

(a) Each inviscid flow determines a relationship  $c = c_0(\alpha)$  where to each  $\alpha$  there are a finite number of bounded values of  $c$ . This assumption will be justified for cases (1) and (2) in the Appendix.

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