Absolute and convective nature of the Eckhaus and zigzag instability with throughflow

Jean-Marc CHOMAZ, Arnaud COUAIRON & Stéphanie JULIEN

Laboratoire d'Hydrodynamique, CNRS-UMR 7646, École polytechnique, F-91128 Palaiseau Cedex, France

Phys. Fluids. **11** (1999), 3369-3373.

Abstract:

The nature of the Eckhaus and of the zigzag instability is investigated for a periodic basic "flow" (a *y*-periodic Stokes solution) in the presence of a transverse or a longitudinal mean flow using the two-dimensional extension of the absolute instability criterion. For each flow orientation, stability diagrams are obtained numerically and analytically for a simple amplitude-equation model considering both the Eckhaus and the zigzag instability. Analytical results extend and correct a previous analysis by Müller and Tveitereid. In particular, for a longitudinal flow, the Eckhaus instability is convective near its instability threshold and the absolute destabilization occurs at a finite wave number. Similar results hold for the zigzag instability for a transverse throughflow which is convective near threshold. In the presence of an arbitrarily oriented mean flow, the absolute threshold for the Eckhaus instability is also numerically determined. Implications of these results for real experiments are discussed.