

LINEAR THEORY OF TAYLOR VORTEX FLOW IN THE INCLINED TAYLOR- COUETTE FLOW SYSTEM

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Abstract

The hydrodynamic of Taylor – Couette flow to keep on with drawing considerably the attention of researchers in view of numerous applications to the rotating machines (turboshaft engine, lubricating, cooling, centrifugation, biorheology, etc...). Meanwhile the subject bring about new fundamental tentatives devoted to the appearance of structures and waves in order to analyses their evolution in laminar- turbulent transition regime towards chaos up to turbulence. Our goal is aimed to investigate theoretically the influence of the angle of the inclination α of the flow system on the phenomena in the condition defined by inner cylinder is rotating and outer is at the rest.

One proposes to formulate the governing equations of the movement in inclined system which is represented in a suitable frame of reference. Thereafter, one establish the linear theory of Taylor instability in the approximation of small gap configuration.

For this purpose, the use of Galerkin method makes it possible to solve the problem with the eigenvalues resulting in establishing the diagram of marginal stability depending on Taylor number Ta in function of wave number a and the inclination α . The obtained theoretical results are in good agreement with our measurements.

Key words:

Rotating flows, laminar turbulent transition, Taylor vortex flow, inclination, small gap, linear theory, stability diagram.