FM13S_12280

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

Influence of Swirl Vibrations on Flow in Long Cylinder

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The object of our consideration is linear stability of azimuthal flow of incompressible viscous fluid within an infinitely long cylinder subjected to swirl vibrations. The boundary velocity varies harmonically with time at a moderate frequency. In this system the most excitable perturbations are found to be axisymmetric at low and moderate (up to frequencies providing the oscillatory Stokes layer thickness $\simeq 1/10$ cylinder radius) frequencies. At the high-frequency limit and at large enough moderate frequencies, non-axisymmetric perturbations uniform along cylinder axis are most excitable. The Floquet solutions are proved to be able to have a negative multiplier only as the particular case of a pair of complex multipliers, and in this case the negative multiplier is doubly degenerated. The perturbations are classified with respect to their solution spatial and temporal symmetry properties; and the different parametric resonances are found to correspond to most effectively exciting perturbations of the different classes.

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