Counterrotating Taylor-Couette flow with axial throughflow

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ABSTRACT

An experimental study of different flow states observed in counterrotating Taylor-Couette flow in the presents of axial throughflow is presented. We observe that either propagating Taylor vortices (PTV) or up- or downwards travelling spirals (SPI ↑ and SPI ↓) appear from the first instability of basic laminar flow. Either of these states is connected to an assimilable state in closed Taylor-Couette flow by a superposition of Poiseuille flow, as shown in [1]. However, flow state exsists in systems with axial throughflow which have no counterpart in a closed flow. We were able to observe such flow states in a system with counterrotating cylinders which have yet only been found in case of fixed outer cylinder [2]. These states are labeled ,,mixed phase-state" and ,,mode-competition state". Both modes are characterised by an interaction of PTV, SPI ↑ and SPI ↓ but show different dynamical behaviour. In particular in the ,,mode-competion state" a obvious temporal alternation between the three different basic states is observed. The convective and absolute instability thresholds of the modes are considered [3],[4]. Moreover an analysis of the spatiotemporal dynamics of the different modes is presented.

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