NUMERICAL INVESTIGATION OF THE FLOW PATTERN IN A COMBINED TAYLOR COUETTE SYSTEM: CYLINDER - SPHERE COMBINATIONS

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Abstract - Taylor-Couette flow is the flow that occurs between two coaxial cylinders where the inner cylinder rotates and the outer one remains stationary. This flow system has become fundamental to the study of instability and nonlinear behavior. Many modifications can be made to Taylor-Couette flow, which can result in much more complex flow structures, by either geometrical changes, or by combining different geometry. The main goal of this work is to investigate numerically the effect of end walls modification on the fluid dynamic behavior. The modeling strategy was developed by studying three types of flow configurations: Classical Taylor-Couette flow, flow between two concentric cylinders with hemispheres on the lower end wall, and flow between two coaxial cylinders combined with hemispheres on the upper and lower end walls. The calculations were carried out to determine the transition zone from laminar Couette flow to the onset of Taylor vortices and wavy vortex flow. The parameter that determines the flow regimes is the Taylor number based on the angular velocity of the inner element. It is established that the different combinations deeply affect the appearance of the first and second instabilities, respectively. The appearance of the different instabilities, the various cell patterns and the velocity profiles have been predicted and presented.