Forced Convection Heat Transfer and Fluid Dynamic of a TaylorCouette Flow in a Horizontal Gap of a Heated Pipe

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Abstract

The present work focuses on the numerical simulation of forced convective heat transfer and fluid dynamic of a TaylorCouette flow in a gap of a horizontal annulus. Both the inner and the outer cylinder are isothermal with the inner rotating cylinder is submitted to a constant and uniform hot temperature while the colder outer cylinder and end plates are maintained stationary. Also, the flat end plates are considered adiabatic. This physical problem of rotating flow is modeled by the conservation equations of continuity, momenta and energy with appropriate boundary conditions and numerically solved by a finite volume method with a second order discretization in time and space. The developed code of calculus offers a perfect agreement with the analytical results of the basic circular Couette flow (CCF). Then, the first campaign of results concerns the case of rotation with zero axial air flow with fixed geometric characteristics and laminar forced convection. The evolution of the thermal and dynamical patterns, from laminar shear flow to laminar shear flow with vortices, is presented for the different variation of the Taylor number.

Keywords: Numerical simulation, rotating flow, annulus pipe, forced convection, laminar shear flow, vortices.