FLOW DEVELOPMENT IN ASYMMETRIC BIFURCATIONS

At the present time, the authors of this work have been discussing with the scientific community, in specialized congresses of the country, studies about the region of development of flow in asymmetric bifurcations, with variation of angles, flow rates and channel diameters. Basically, the authors' proposal was to develop a mathematical formulation in the classic literature format, that is, \( L = k(2R)^m(\text{Re}^n)(D^p) \), which describes the length \( L \) of the entry region in each outlet of the bifurcations. This equation is inspired by mathematical propositions adopted for prediction in toroidal and helical geometries of conventional pinning, as well as in symmetric bifurcations of microchannels, which consider \( R \) as the radius of curvature of the tube, \( \text{Re} \) the Reynolds number (which in itself translates to flow velocity, viscosity, and density of the fluid) as well as \( D \), the internal diameter or hydraulic diameter, where the flow develops. To effectively raise the coefficients \( k \), \( m \), \( n \) and \( p \), used in the proposed format, Navier-Stokes and Energy equations, which govern the fluid dynamic phenomenon, under appropriate constraints, were implemented in finite difference method. The fluid used was water under NTP conditions. Numerical files were obtained and images were generated from such files, through the application of conventional technique CFD (Computational Fluid Dynamics) that employed structured computational language. In this way, the region of flow development was measured. In addition, it was used a commercial software that works with finite elements, to compare images and test the effectiveness of the simulation in finite differences. The results of length \( L \) reached in CFD were introduced in the equation and the values of \( k \), \( m \), \( n \) and \( p \) were raised with the aid of the software Mathcad(TM). The best values of exponents, within the flow ranges, angles and diameters tested, resulted in the equation \( L = 2.69(2R)^{-0.1}(\text{Re}^{0.59})(Dh^{1.1}) \), which is presented as a coherent formulation in the physical and dimensional points of view. The development of a prediction equation for the thermal entrance length, in a method similar to the present one, is recommended to complete the study of the entrance region in bifurcations.