RESUMO

Navier-Stokes and energy equations as tooling for description of flow phenomena are object of interest for a high number of scientists that work with mechanical engineering. On one hand, the straight stretch of a pipe of circular cross section with a flux in laminar regime is pretty easy to understand, once the velocity profile is described by a simpler solution of the momentum equations, lending it a parabolic shape, with a null value at the wall and a peak value at the middle of the flow. Consequently, prediction of temperature gradients is also easier because there will be only one component of velocity to be considered in the energy equation. On the other hand, the issue in turbulent regime is a little more complicated. Specifically for curved and coiled tubes of circular section, studies of flowing have been exhaustively performed. According recent literature, in pretty much one century, approximately 5,000 U.S. patents were registered and more than 10,000 research articles were performed on curved tube geometries and their applications. In terms of coordinates to be applied on the treatment of the problem in the curve, the most common sense has been to employ toroidal ones. Taking all of that into account, the aim of this work is to present shapes and values of velocity fields and temperature gradients achieved through numerical simulation of a flow in a curved tube followed by a straight stretch of a piping. The finite difference method is employed to treat equations. A flowing between a refinery and a distribution terminal in Brazilian Northeastern region is the case in highlight. Predictions through a commercial code that works with finite element method are also accomplished, as additional comparison source. Three conditions of flow rate and initial temperature are tested, all of them at a very low Reynolds and Dean Numbers and very high Prandtl number. Department in straight stretch is verified for a length of 30 meters with no insulation, at the middle of the insulated piping, where there is a reduction in thickness, through which a loss of heat takes place. The strategy to predict velocity and temperature behavior inside the curve is simulating the flow through two cylindrical surfaces which compose the two principal elements of symmetry of the flowing process. Results obtained in straight stretch simulation achieved endorsement by in situ measurements, commercial code and literature. Results caught through cylindrical surfaces on the curve show good coincidence with results of the commercial code and literature and could represent a simpler way to treat the classical issue of the flow in a toroidal stretch.