Abstract

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Numerical investigation of curvature and torsion effects on water flow field in helical rectangular channels

Helical channels have a wide range of applications in petroleum engineering, nuclear, heat exchanger, chemical, mineral and polymer industries. They are used in the separation processes for fluids of different densities. The centrifugal force, free surface and geometrical effects of the helical channel make the flow pattern more complicated hence it is very difficult to perform physical experiment to predict channel performance. Computational Fluid Dynamics (CFD) can be suitable alternative for studying the flow pattern characteristics in helical channels. The different ranges of dimensional parameters, such as curvature and torsion, often cause various flow regimes in the helical channels. In this study, the effects of physical parameters such as curvature, torsion, Reynolds number, Froude number and Dean Number on the characteristics of the turbulent flow in helical rectangular channels have been investigated numerically, using a finite volume RANSE code Fluent of Ansys workbench 10.1 UTM licensed. The physical parameters were reported for range of curvature (?) of 0.16 to 0.51 and torsion (?) of 0.032 to 0.1 .The numerical results of this study showed that the decrease in the channel curvature and the increase in the channel torsion numbers led to the increase of the flow velocity inside the channel and the change in the shape of water free surface at given Dean, Reynolds and Froude numbers.