

عنوان مقاله:

Numerical investigation of flow structure and convective heat transfer enhancement inside the tube using different geometries of twisted tapes insert

محل انتشار:

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خلاصه مقاله:

In the present work, a numerical study on the heat transfer and fluid flow features in straight tubes is done. The thesis simulation includes both tubes with and without twisted tapes. The flow regime is considered turbulent with Re numbers of 3333, 4333, 5333, 6333, and 7333. The study is not time dependent. Simulation is 3-D and includes 3 main steps: 1 - investigation of pitches of twisted tapes. 2 - investigation of the twisted tapes with several blades. 3 - investigation of twisted tapes with cut edges. The results of the Nu number represent that the addition of a twisted tape insert is beneficial in increasing heat transfer. As can be seen, the optimum twisting pitch is found to be 3105 cm. Looking into the pressure drop penalty, it can be observed that straight tubes with twisted tape have a higher pressure drop. Twisted tape with a pitch of 3105 cm has more friction factor. Twisted tape with a pitch of 3105 cm has the highest productivity index. Therefore, this pitch will be used in the next step. According to Nu number, both double and triple-twisted tapes are better than single-twisted tapes however, it is obvious that the impact is considerable only in high Re numbers. It can be observed that the triple case has more friction factor than double and single. The biggest gap is related to $Re=7333$. In this Re number triple case's friction factor is about 30% more than the single case and almost 10% more than the double case. Based on the productivity index, for a low Re number meaning that lower than 4333, single twisted tape can be better, and for a higher Re number than 4333, triple twisted tape can be better. Ultimately, based on P.I., among 3 cases of triple twisted tapes with 3105 pitches with 1, 2 cut edges and without cut edge, case 2 (triple twisted tapes with 3105 pitches with 1 cut edge) has better results.

کلمات کلیدی:

Numerical analysis, Convective heat transfer, turbulent flow, Twisted tape, pressure drop

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