

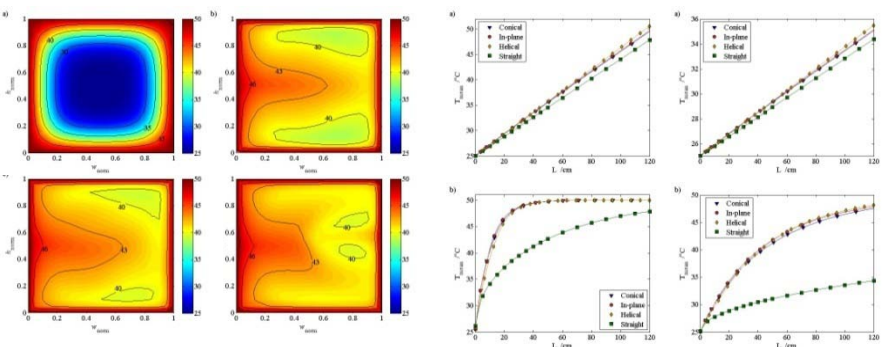
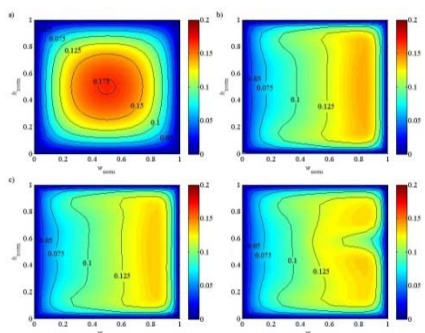
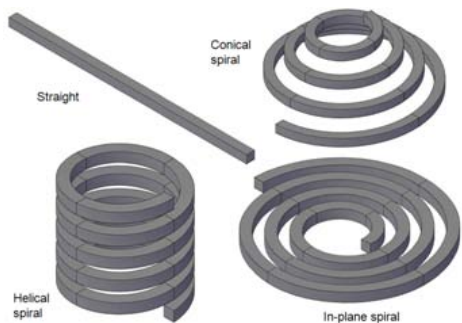
Coiled tubes: Fundamentals and Applications

Coiled tubes have been widely used in process industries due to their compactness, high heat transfer rate and ease of manufacture. They are commonly used as heat exchangers and chemical reactors.

The current study investigates the heat transfer performance of coiled noncircular tubes with the aim to determine potential advantages and limitations of coiled noncircular tubes and provide design guidelines for their applications.

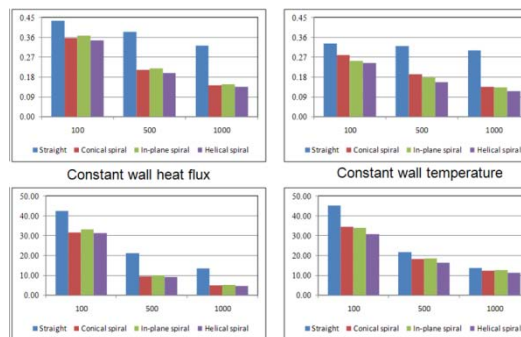
Mathematical model

A mathematical model for laminar flow of a Newtonian fluid in helical coils with square cross-section is developed. Two thermal boundary conditions – constant wall temperature and constant heat flux – were simulated. The effect of Prandtl number was investigated by conducting simulations for air and water



Heat transfer performance

As regards the heat transfer performance and pressure drop in the system, the figure of merit concept is introduced to account for the effectiveness of heat transfer performance over pressure drop.



It is found that even though coiled ducts give higher heat transfer rate, they also impose higher pressure drop penalty. As a result, the figure of merit of the coiled ducts is lower than that of straight duct.

However, for the operation where space is limited and pumping power is not an issue, the coiled duct can be a desired choice. More studies are carried out to investigate evaluate other parameters.

Work is underway on thermal performance with nanofluids, pcm-encapsulated suspensions, non-Newtonian fluids, reacting flows (single phase and two phase) as well as erosion in flow of suspensions in coils.

Relevant publication:

J.C. Kurnia, A.P. Sasmito, A.S. Mujumdar, Evaluation of heat transfer performance of helical coils of non-circular tubes, J. Zhejiang Univ. Sci. A., 2010, accepted.

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