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Experimental study on transient behavior of embedded spiral-coil heat exchanger
(2015) *Mechanical Sciences*, 6 (2), pp. 181-190.

Abstract
Spiral coil offers a substantial amount of heat transfer area at a considerably low cost as it does not only have a lower wall resistance but it also achieves a better heat transfer rate in comparison to conventional U-tube arrangement. The general aim of the study is to assess different configurations of spiral coil heat exchangers that can eventually operate in a highly efficient manner. The paper documents the transient behavior of spiral-shaped tubes when the coil is embedded in a rectangular conducting slab. Different arrangements and number of turns per unit length, with fixed volumes, are considered in order to figure out the optimal configuration that maximizes the performance of the heat transfer. The implementation presented in the study is conducted to demonstrate the viability of the use of a large conducting body as supplemental heat storage. The system uses flowing water in the coil and stagnant water in the container. The copper-made coils situated in the center of the slab carries the cold fluid while the container fluid acts as a storage-medium. The water temperature at several depths of the container was measured to ensure uniformity in the temperature distribution of the container medium. Results have shown that the coil orientation, the number of loops, and the Reynolds number, substantially influence the rate of the heat transfer. The vertically-embedded spiral coil has a better performance than the horizontally-embedded spiral coil. Doubling the number of loops is shown to enhance the performance of the coil. Increasing Reynolds Number leads to better coil performance. © Author(s) 2015.

2-s2.0-84941555452
Document Type: Article
Publication Stage: Final
Source: Scopus
Access Type: Open Access