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Numerical Study of Fluid Flow and Heat Transfer in the Spongy-Porous Media

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Abstract : Numerical study of fluid flow, heat transfer and thermal energy storing or released in/from spongy-porous media to predict the thermal performance and characteristics of the porous media as packed bed system is presented in this work. This system is cylindrical channel filled with porous media (carbon foam). The system consists of working fluid (air) and spongy-porous medium; they act as the heat exchanger (heating or cooling modes) where thermal interaction occurs between the working fluid and the porous medium. The spongy-porous media are defined by the different type of porous medium employed in the storing or cooling modes. Two different porous media are considered in this study: Carbon foam, and Silicon rubber. The flow of the working fluid (air) is one dimensional in the axial direction from the top to downward and steady state conditions. The numerical results of transient temperature distribution for both working fluid and the spongy-porous medium phases and the amount of stored/realized heat inside/from the porous medium for each case with respect to the operating parameters and the spongy-porous media characteristics are illustrated.

Keywords : fluid flow, heat transfer, numerical analysis, spongy-porous media, thermal performance, transient conditions
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