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# Energy Conservation in Heat Exchangers

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**Abstract :** Energy conservation is one of the major concerns in the modern high tech era due to the limited amount of energy resources and the increasing cost of energy. Predicting an efficient use of energy in thermal systems like heat exchangers can only be achieved if the second law of thermodynamics is accounted for. The performance of heat exchangers can be substantially improved by many passive heat transfer augmentation techniques. These letters permit to improve heat transfer rate and to increase exchange surface, but on the other side, they also increase the friction factor associated with the flow. This raises the question of how to employ these passive techniques in order to minimize the useful energy. The objective of this present study is to use a porous substrate attached to the walls as a passive enhancement technique in heat exchangers and to find the compromise between the hydrodynamic and thermal performances under turbulent flow conditions, by using a second law approach. A modified k- ε model is used to simulating the turbulent flow in the porous medium and the turbulent shear flow is accounted for in the entropy generation equation. A numerical modeling, based on the finite volume method is employed for discretizing the governing equations. Effects of several parameters are investigated such as the porous substrate properties and the flow conditions. Results show that under certain conditions of the porous layer thickness, its permeability, and its effective thermal conductivity the minimum rate of entropy production is obtained.

**Keywords :** second law approach, annular heat exchanger, turbulent flow, porous medium, modified model, numerical analysis
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