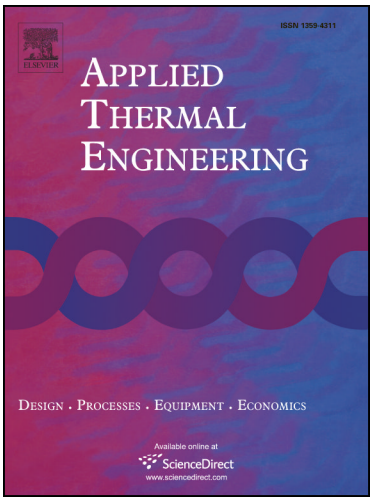

Research Paper

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Optimization of Flat Plate Solar Air Heaters with Ribbed Surfaces

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ABSTRACT

In this study, the effect of repeated ribs on the thermal performance of a flat plate solar air heater is investigated. Thermal model of the air heater is developed based on the semi empirical heat transfer equations. The genetic algorithm is used to find the optimum set of parameters in an air heating application. An experimental test rig is designed and built not only to evaluate the validity of the semi empirical correlations, but also to extend the range of application of the equation. The optimization is performed to meet two objectives, to attain higher thermal efficiency and to guarantee a desired temperature difference between the inlet and outlet of the air flow. It was found that employing ribs in a flat plate solar air heater improves the thermal efficiency by more than 9% under the low air mass flow conditions. However, at the higher air flows or when negligible temperature difference is desired, the additional power required to overcome the pressure drop due to the ribs may degrade the performance of the air heater.

Keywords

Optimization, Genetic algorithm, Solar air heater, Ribs, Heat transfer augmentation.

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