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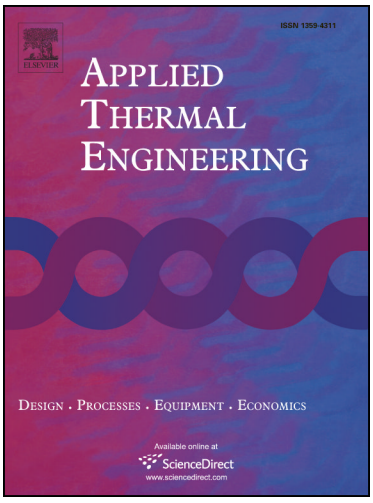

Research Paper

Numerical and Experimental Investigation of Wind Effect on a Hemispherical Cavity Receiver

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Numerical and Experimental Investigation of Wind Effect on a Hemispherical Cavity Receiver

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Abstract

In this study, a parabolic dish concentrator with a hemispherical cavity receiver was investigated under windy weather conditions. In the first section, a numerical analysis was carried out to determine an optimum structural parameter of the hemispherical cavity receiver. Two equations were numerically determined for prediction of the optimum aperture area of the cavity receiver and the maximum receiver thermal efficiency versus the optical errors in the range of 5 mrad to 35 mrad. In the second section, the optimized hemispherical cavity receiver was experimentally constructed, and the experimental tests were carried out in a real weather condition. The effect of the wind speed on the cavity heat losses was experimentally investigated. A correlation between the heat losses, due to the wind, and the wind speed was experimentally estimated in form of the $\dot{Q}_{loss,wind} = 59.545 \times V_{wind} + 76.724$. The correlation was obtained for the investigated hemispherical cavity receiver with R^2=0.9477 for the side wall direction of the wind. The cavity wall temperatures show an inverse behavior with the wind

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