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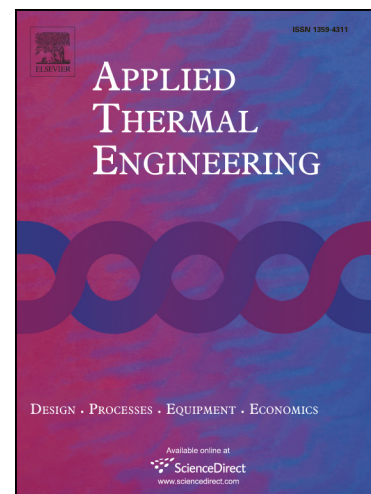
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Numerical analysis of inserts configurations in a cavity receiver tube of a solar power tower plant with non-uniform heat flux

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Abstract: In order to analyse the effects of inserts configurations on heat transfer performance of solar cavity receiver tube (RT), a three-dimensional numerical model with four different inserts under non-uniform heat flux boundary condition was developed. Based on this model, the effects of inserts configurations, the effects of non-uniform heat flux boundary condition, the effects of thickness and positions of twisted-tape were analyzed. The numerical results show that RT-I with the twisted-tapes has the better comprehensive performances than those of other three kinds of RTs, and the RT-I with twisted-tapes is recommended to the solar cavity tower receiver. The twisted-tape RT-I has the highest Nu and the lowest circumferential temperature difference ΔT and average temperature of outer surface of receiver tube T_m , which are 21.74, 43 K, and 586K, respectively. In addition, the thickness of twisted-tape has the significant effect on heat transfer performances of RTs. The twisted-tape with much more thickness will enhance the heat transfer and reduce the ΔT and T_m . Moreover, under the non-uniform boundary heat fluxes, RT-I with twisted-tapes placed in the back-sunlight domain is favorable than that of twisted-tapes placed in the sunlight concentrated domain. The contribution can provide a reference for this type of receiver design and reconstruction.

Keywords: solar power tower plant; cavity receiver tube; non-uniform heat flux boundary condition; different inserts configurations

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