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A DYNAMIC HEAT TRANSFER MODEL TO INVESTIGATE THE EFFECT OF APERTURE SIZE ON THE TEMPERATURE OF A SOLAR RECEIVER

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ABSTRACT. Maintaining semi-constant high temperatures inside a solar reactor is a challenge because of the transient nature of the incident solar radiation. For fixed aperture size reactors, changes in incident solar flux directly affect the temperature inside the reactor because of not compensating the fluctuations in incoming solar energy. The present study deals with the dynamic modeling of a solar receiver to simulate the effect of aperture size on the system behavior during unsteady state conditions. Radiation heat transfer analysis of the receiver is studied via Monte Carlo (MC) ray tracing method. MC ray tracing module is coupled to unsteady energy equation solver to develop a model describing the transient behavior of the system. The effect of aperture size on the cavity temperature profile as well as the outlet gas temperature has been investigated and the results confirmed that wide range of temperatures is achievable by changing the aperture size. The paper also demonstrates a thorough comparison on the effectiveness of temperature control via change of aperture size versus via change of gas flow rate. The results show that the change in aperture size can influence the system dynamics more effective than the change in gas flow rate.