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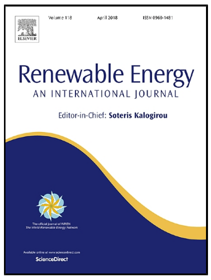

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Dynamic performance of an aiming control methodology for solar central receivers due to cloud disturbances

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Abstract

An appropriate control of the heat flux distribution over the solar central receiver is essential to achieve an efficient and safe operation of solar tower systems. High solar radiation variation due to moving clouds may cause failures to the solar receiver. This paper shows a dynamic performance analysis of a solar central receiver operating when short-time cloud passages partially shade the solar field. The solar receiver incorporates an aiming methodology based on a closed loop model predictive control approach. The DNI changes are simulated using an agent-based model that closely emulates the transients in solar radiation caused by clouds. These models are coupled with a solar system model that resembles the Gemasolar solar plant. The simulations showed that the base feedback loop aiming strategy could successfully restore the solar receiver back to its steady state after transient operations caused by clouds. However, undesired overshoots in incident flux density and high heating rates in the controlled variables were found. These issues are overcome through a setpoint readjustment approach, which is temporally supported by a PI controller. The results show that the proposed aiming control strategy can provide a continuous safe operation of the solar central receiver when subject to transient flux distribution due to clouds.

Keywords: Solar central receiver; Heliostat aiming; Multivariable closed control loop; Concentrating solar thermal; Cloud disturbances

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