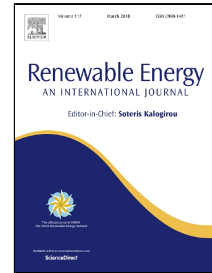


Accepted Manuscript

Three-dimensional transient numerical model for the thermal performance of the solar receiver

Li Xu, Wes Stein, Jin-Soo Kim, Zhifeng Wang



PII: S0960-1481(17)31259-4
DOI: 10.1016/j.renene.2017.12.055
Reference: RENE 9552
To appear in: *Renewable Energy*
Received Date: 25 September 2017
Revised Date: 30 November 2017
Accepted Date: 15 December 2017

Please cite this article as: Li Xu, Wes Stein, Jin-Soo Kim, Zhifeng Wang, Three-dimensional transient numerical model for the thermal performance of the solar receiver, *Renewable Energy* (2017), doi: 10.1016/j.renene.2017.12.055

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Three-dimensional transient numerical model for the thermal performance of the solar receiver

Li Xu^{1,2,*}, Wes Stein², Jin-Soo Kim², Zhifeng Wang¹

¹ Key Laboratory of Solar Thermal Energy and Photovoltaic System of Chinese Academy of Sciences, Beijing Engineering Research Center of Solar Thermal Power, Institute of Electrical Engineering, Chinese Academy of Sciences, Beijing 100190, China

² CSIRO Energy Technology, P.O. Box 330, Newcastle, NSW 2300, Australia

Abstract:

For solar thermal power plants, no steady-state operation occurs in view of inherently transient natures of their initial and boundary conditions. So this study proposes a mathematical model to perform the analysis on the transient behaviors of the external solar receiver in the tower power technology. This 3D transient model was established by dividing the receiver tube into discrete control volumes and then applying the conservation of thermal energy to every single differential control volume. In addition, this model was validated by simulating the HTF temperature distributions and then comparing them with the reference results. By calculating the time-dependent and non-uniform temperature fields of the receiver tube, this paper focuses attention on the evolution of transient processes in several common scenarios involving the mass flowrate variation, the start-up process and the occurrence of the heavy clouds above the heliostat field. Particularly, the analysis of the transient thermal performance highlights some noteworthy characteristics including serious problems such as the corrosion, the thermal stress and the fatigue in the typical transitions, which might require the control system to correspondingly adjust in time.

Keywords: External solar receiver; Tower technology; Molten salt; Thermal

* Corresponding author. Tel: +86 10 82547268. E-mail address: xuli_neu@126.com

Download English Version:

<https://daneshyari.com/en/article/6764894>

Download Persian Version:

<https://daneshyari.com/article/6764894>

[Daneshyari.com](https://daneshyari.com)