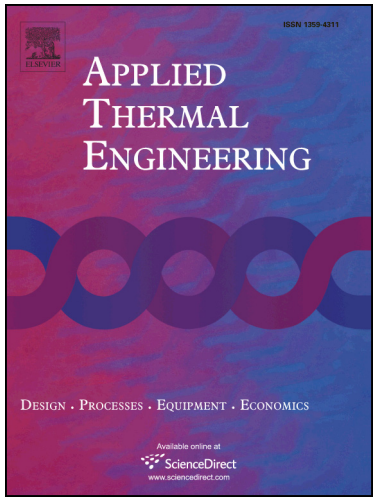
Accepted Manuscript



Research Paper

Prospective fully-coupled multi-level analytical methodology for concentrated solar power plants: General modelling

Lu Li, Jie Sun, Yinshi Li

PII: S1359-4311(16)34469-6
DOI: http://dx.doi.org/10.1016/j.applthermaleng.2017.02.086
Reference: ATE 9967

To appear in: *Applied Thermal Engineering*

Received Date: 28 December 2016
Revised Date: 16 February 2017
Accepted Date: 20 February 2017

Please cite this article as: L. Li, J. Sun, Y. Li, Prospective fully-coupled multi-level analytical methodology for concentrated solar power plants: General modelling, *Applied Thermal Engineering* (2017), doi: http://dx.doi.org/10.1016/j.applthermaleng.2017.02.086

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.

ACCEPTED MANUSCRIPT

Prospective fully-coupled multi-level analytical methodology for concentrated solar power plants: General modelling

Lu LI[1], Jie SUN[2*], Yinshi LI[1*]

[1]Key Laboratory of Thermo-Fluid Science and Engineering of MOE, School of Energy and Power Engineering, Xi'an Jiaotong University, Xi'an, Shaanxi 710049, China

[2]Institute of Engineering Thermophysics, Chinese Academy of Sciences, Beijing 100190, China

Abstract

The complexity of the cascading solar-thermal-mechanical-electrical energy conversion in concentrated solar power (CSP) plants urges to develop an accurate and fast analytical methodology for on-site use. Herein, we propose a novel fully-coupled multi-level analytical methodology, where multi-dimensional model (0-1-2-3 Model) is developed to address the optical-hydraulic-thermal-elastic synergistic issue in CSP plants: i) At system-level, the 0 Sub-Model reveals the heat-work transformation in power block in the view of thermodynamics; ii) At loop-level, the 1 Sub-Model uncovers the collection, concentration and transformation of solar energy into the working fluid in the loop on account of 1D thermo-hydraulics; iii) The 2 Sub-Model, employing 2D finite volume method (FVM), figures out the detailed circumferential temperature profile of receiver tubes in terms of composite heat transfer; iv) At component-level, the 3 Sub-Model, using 3D finite element method (FEM), brings insight into the nonuniform-temperature-induced deformation of receiver tubes focusing on the thermo-elastics. The 0-1-2-3 Model enables both system-level performance prediction and component-level targeting insight in a remarkably high-efficient way with guaranteed accuracy. In comparison, the computational

*Authors to whom correspondence should be addressed. Electronic mails: sunjie@mail.etp.ac.cn (JS), ysli@mail.xjtu.edu.cn (YSL)

Download English Version:

https://daneshyari.com/en/article/4991350

Download Persian Version:

https://daneshyari.com/article/4991350

Daneshyari.com