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Performance and Design Optimization of Solar Collectors

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Abstract: The objective of the present work was to conduct a comparative analysis of solar collectors. The experimental set-up consists of two flat plate solar collectors, the first collector was with a fixed surface tilted at 30° towards the South, and the second one was equipped with dual-axis rotation system. A programmable chronological tracker was used to control the motion of the moving collector. An experimental programme was performed to investigate the effect of the sun tracking system usage on the collector efficiency. The study includes development of a 3-D mathematical model of the system and extensive numerical simulation, based on the computational fluid dynamics (CFD) approach. The main aim of the modelling is to provide information on heat transfer, and to numerically simulate the heat transfer performances and the energy capture capabilities of the fixed and moving collectors in various operating modes. The comparative analysis shows that there is a good agreement between the experimental and numerically predicted results for different running conditions, and the presented modelling approach can be used for further investigations, including more complex problems.

Keywords: Solar collector, Solar energy, Heat transfer

Introduction

One of the simplest and most direct applications of the solar energy, which is cost effective, is its conversion into heat. It is also one of the ways the residential and other sectors can lessen their share in electricity consumption and impact on the environment. The cost effectiveness of solar thermal collectors depends on the cost of collector components, the efficiency and the thermal losses associated with the collector at the local operating conditions. Flat plate solar water heaters are traditionally in use in domestic hot water systems because of the low temperature requirement and low equipment cost (Sumathy, 1999). Conventional solar water heater systems and solar assisted heat pump systems for hot water production in specific local conditions are presented in (Li & Yang, 2009).

A 3-D numerical model for flat-plate solar collector that considers the multidimensional and transient character of the problem, the effect of the non-uniform flow on the collector efficiency was quantified and the degree of deterioration of collector efficiency was defined by Molero - Villar et al.(2009). Their analysis showed that this deterioration increases with the increase of the flow non-uniformity, although this effect is very limited. The model was verified with a steady-state conditions.

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Solar Engineering 2003 Proceedings

Qun Jie Xu, Yong Guang Li, Xiu Yang



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Solar Engineering 2003 Mark D. Thornbloom, Scott A. Jones, 2003 SOLAR ENERGY CONVERSION AND PHOTOENERGY SYSTEMS: Thermal Systems and Desalination Plants-Volume IV Julian Blanco Gálvez, Sixto Malato Rodríguez, E. Delyannis, Vassilis G. Belessiotis, S. C. Bhattacharya and S. Kumar, 2010-11-20 Solar Energy Conversion and Photoenergy Systems Thermal Systems and Desalination Plants theme in five volumes is a component of Encyclopedia of Energy Sciences Engineering and Technology Resources in the global Encyclopedia of Life Support Systems EOLSS which is an integrated compendium of twenty one Encyclopedias The Theme on Solar Energy Conversion and Photoenergy Systems Thermal Systems and Desalination Plants with contributions from distinguished experts in the field discusses solar energy renewable energy thermal systems and desalination systems some of which are already in commercial and practical applications and others are under research and testing level The volumes provide an analysis and discussion about the reasons behind the current efforts of our society considering both developed and developing countries to accelerate the exploitation of the huge solar energy potential in our normal daily lives The five volumes also provide some basic information about the solar energy potential history and the amazing trip of a photon from its creation in the Sun until its arrival to the Earth These five volumes are aimed at the following five major target audiences University and College Students Educators Professional Practitioners Research Personnel and Policy Analysts Managers and Decision Makers NGOs and GOs **Solar Engineering** American Society of Mechanical Engineers. Solar Energy Division. Conference, 2006 **Energy Conversion** D. Yogi Goswami, Frank Kreith, 2007-07-06 Discussing methods for maximizing available energy Energy Conversion surveys the latest advances in energy conversion from a wide variety of currently available energy sources The book describes energy sources such as fossil fuels biomass including refuse derived biomass fuels nuclear solar radiation wind geothermal and ocean then provides the terminology and units used for each energy resource and their equivalence It includes an overview of the steam power cycle gas turbines internal combustion engines hydraulic turbines Stirling engines advanced fossil fuel power systems and combined cycle power plants It outlines the development current use and future of nuclear fission The book also gives a comprehensive description of the direct energy conversion methods including Photovoltaics Fuel Cells Thermoelectric conversion Thermionics and MHD It briefly reviews the physics of PV electrical generation discusses the PV system design process presents several PV system examples summarizes the latest developments in crystalline silicon PV and explores some of the present challenges facing the large scale deployment of PV energy sources The book discusses five energy storage categories electrical electromechanical mechanical direct thermal and thermochemical and the storage media that can store and deliver energy With contributions from researchers at the top of their fields and on the cutting edge of technologies the book provides comprehensive coverage of end use efficiency of green technology It includes in depth discussions not only of better efficient energy management in buildings and industry but also of how to plan and design for

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Solar Engineering 2003 Proceedings Book Review: Unveiling the Magic of Language

In an electronic digital era where connections and knowledge reign supreme, the enchanting power of language has become more apparent than ever. Its ability to stir emotions, provoke thought, and instigate transformation is really remarkable. This extraordinary book, aptly titled "**Solar Engineering 2003 Proceedings**," compiled by a highly acclaimed author, immerses readers in a captivating exploration of the significance of language and its profound effect on our existence. Throughout this critique, we will delve into the book's central themes, evaluate its unique writing style, and assess its overall influence on its readership.

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