Novak Nikolić[1)]
Nebojša Lukić[1)]
Dragan Taranović[1)]

1) Faculty of Engineering, University of Kragujevac, Serbia {lepinole@yahoo.com, lukic@kg.ac.rs, tara@kg.ac.rs}

RESULTS OF THE EXPERIMENTAL VERIFICATION OF THE MATHEMATICAL MODEL OF THE THERMAL BEHAVIOUR OF A DOUBLE EXPOSURE FLAT-PLATE SOLAR COLLECTOR

Abstract: *The double exposure flat-plate solar collector (DEFPC) is a solar collector which can absorb solar radiation by upper as well as lower absorber surface. Absorption from lower absorber surface is enabled by application of a flat-plate reflector. The reflector is placed in parallel below the collector. To enable absorption from the lower absorber surface, it is necessary, beside the reflector, for the insulation mounted on the lower part of the collector box to be removed and the lower box surface replaced by a glass cover. In this paper the results of the experimental verification of the mathematical model of the thermal behaviour of a DEFPC are presented. The experiments were performed in the months of August, September and October of 2012.Theoretical and experimental results of the thermal power of the analyzed DEFPC for the five selected dates are presented. The mean daily deviations of the theoretical results range from 3.43% to 7.23%.*
Keywords: *Solar collector, Reflector, Experiment*

1. INTRODUCTION

A double exposure flat-plate solar collector (DEFPC) is a solar collector which can absorb solar radiation simultaneously from both its upper and lower absorber surfaces (LAS). Absorption of irradiation from the LAS is accomplished using a flat-plate reflecting surface (reflector) placed in parallel below the collector. On the other side, absorption from the upper absorber surface is the same as that in the conventional flat-plate solar collector (FPC). To enable absorption from the lower absorber surface, it is necessary for the insulation mounted in the lower part of the collector box to be removed and the lower box surface replaced by glass cover. In relation to the previously investigated systems [1-4], the analyzed collector-reflector system (CRS) is different for many reasons. The first reason is parallelism between the collector and reflector. In this way, the incident angle of the solar beam falling on the upper absorber surface is the same as the incident angle of the solar beam reflected onto the LAS. The second reason relates to the fact that the used reflective surface in this system is a plexiglass mirror. With the mirror surface the reflection is specular, which means that the incident and reflected angles are the same. The reflector is movable in all three possible orthogonal directions: north-south, east-west and normal to its surface. Reflector dimensions are approximately the same as dimensions of the collector. In order to define the optimum position of the reflector relative to the collector, theoretical investigation and verification of the mathematical model for determining the irradiated area of the LAS of the DEFPC were carried out [5]. At the same time with testing the DEFPC, the flat-plate solar collector (FPC) with single glazing and identical absorber characteristics was also tested in order to define the differences in their performance. This paper relates to the results of the experimental verification of the mathematical model of the thermal behaviour of a DEFPC.

2. EXPERIMENT

The experimental installation of the tested solar collectors is located in the Laboratory for Thermodynamics and Thermotechnics at the