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Flat Plate Solar Collector With Rough Material Absorber

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ABSTRACT

The article focuses on the numerical analysis of a plat solar collector operating in a dynamic mode. Enhancing the performance of this particular solar collector involves two main aspects: optimizing the losses through the various components of the solar collector on the other. This study investigates the impact of the number of glazing layers in two types of solar collectors: a single-glazed solar collector and a double-glazed solar collector. Additionally, we analyze the effect of absorber roughness.

Keywords: Solar collectors, glazing layers, numerical analysis, heat transfer.

1. Introduction

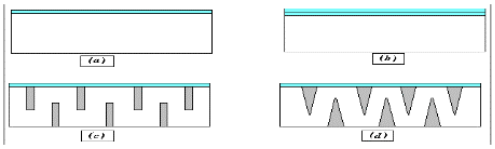
Solar air plane sensors harness the radiant energy from the sun and transform it into heat energy by directing the airflow through the sensor. This energy can be utilized for a wide range of solar applications, including grain or wood drying, heating industrial facilities for residential purposes and even solar-powered refrigeration. To significantly enhance the performance of these systems, a method for optimizing the air stream involves the incorporation of movable thin metal barriers, known as baffles, which create artificial roughness. The strategic placement of these artificial roughness elements in various forms and shapes on the surface where air and the absorber interact, aiming to optimize the overall system performance. The artificial roughnesses serve two main purposes that facilitate heat transfer to the coolant:

a) They help make the turbulent flow in the vicinity of the hot plate,
b) And prolong the course of the heat transfer fluid.

2. Experimental

In this work, we examine the influence of the number of windows are studied two types of solar collectors: a single-glazed solar collector solar collector and double glazing. Second, we studied the influence of the roughness of the absorber; to do so, we compare two types of absorbers:

- Absorber with triangular baffles
- Absorber with rectangular baffles.



3. Results and Discussion

A. Collector without baffles with single glazing

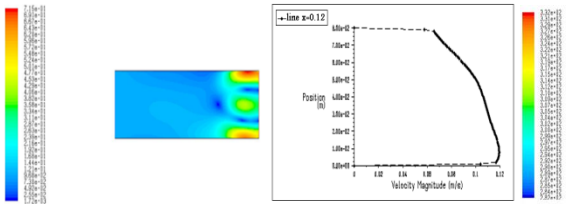


Fig 1 : Velocity in the middle x=0.12m

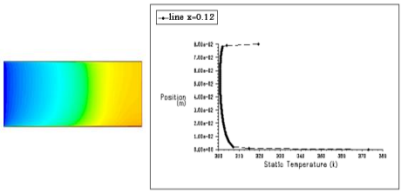


Fig 2 : Température in the middle x=0.12

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B. Collector without baffles with diuble glazing:

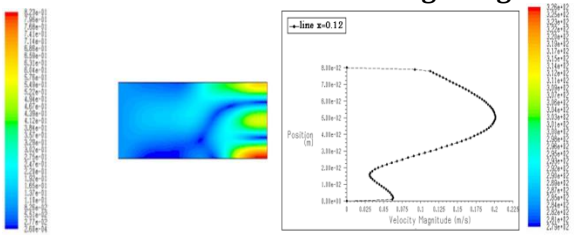

Fig 3 : Velocity in the middle x=0.12m

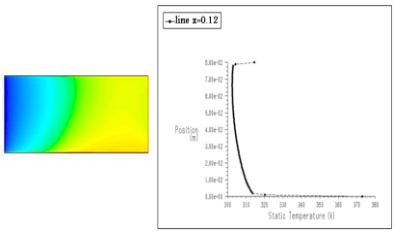

Fig 4 : Température x=0.105m and x=0.135m

C. Collector whith triangular baffles :

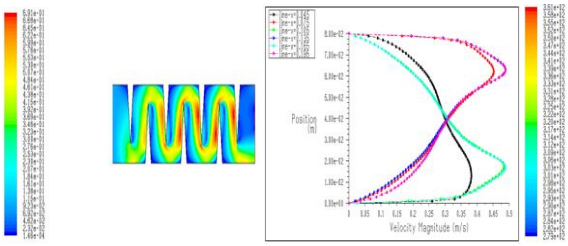

Fig 5 : The axial velocity

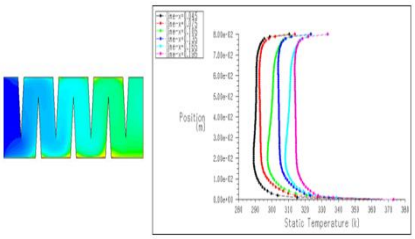

Fig 6 : Température profiles

D. D Collector whith rectangulars baffles

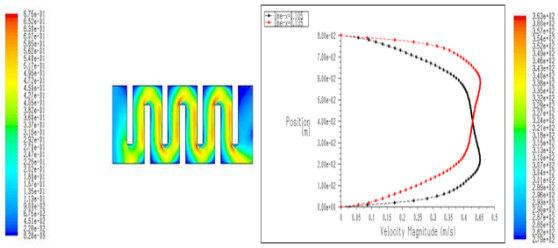

Fig 7 : The axiale velocity

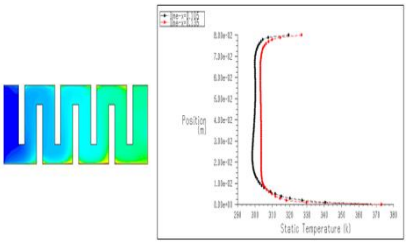

Fig 8 : Température profiles x=0.105m and 0.135m

4. Conclusions

Firstly, incorporating two windows in the sensor channel led to a notable enhancement in heat transfer. There exists an inverse relationship between the axial velocity of the air and the temperature within each cross section. Secondly, the shape of the absorber significantly impacts the sensor's performance. Triangular baffles are particularly effective in achieving higher flow temperatures due to the creation of a larger recirculation zone in the upper portion downstream of the baffle.

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