

Design and Analysis of Solar Flat Plate Collector

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ABSTRACT

Solar light based energy is open in broadly yet least used of available harmless to the ecosystem power resources. Solar based Energy is used for household and industrial purposes. Water warming requires heat, which is made generally with burning by forces (Methane, Gasoline) and these energizes are extra vacant and causes pollution. If we use solar energy which is available for close to 8-12 hours in every places, so we can save a lots of solar energy. Generation is a critical device for the arrangement and movement control. Arrangement engineers use reenactment results to design water warming systems, generation makes it possible to find the ideal arrangement and working limits. In this paper, CFD analysis can make sure that fluid flow of arrangement pathway in mechanical assemblies have been used to reenact solar based finders to all the more promptly heat move limit. 3D-model of the level plate authority with different stream areas is made by using Solid works. Outlet pressure, temperature and solar based radiation are analyzed. We can use our results to improve the efficiency of level plate solar put together position speculation later on. These results can similarly be used for arrangement purposes.

KEYWORDS

Solar Energy, Numerical, Simulation, Optimal Design, Computational Fluid Dynamics, Solid Works, Ansys Fluent.

Introduction

A solar Plate Collector is a heat exchanger that collects the solar power by sunlight based arranged energy from the solar into heat energy using the outstanding impact. It assembles, or gets, solar situated energy and usages that energy to heat the water for, producing the products and materials in industrial works, and also be used to heat the outdoors pools and boiling tubs. The most private part and industrial boiling water applications, the solar oriented controlled level plate more practical on account of their fundamental arrangement, negligible exertion, and decently easier foundation stood out from various sorts of high temp water warming systems. Also, daylight based level plate finders are an overabundance measure of warmed water at the vital temperature. A solar light based level plate finder routinely includes a heat holding plate, typically a gigantic sheet of copper or Aluminum as they are both satisfactory transmitters of heat, (1) solar oriented level plate plan based radiationAs could sensibly be considered typical for most limit efficiency. This obscured heat immersing surface has a couple of equivalent copper lines or chambers called risers,

Running length ways across flat plate contain fluid, commonly water. These number of turns of copper tubes are fortified, fixed or straight forwardly to the defend plate to ensure most limit surface contact and flow of heat move. Light warms the holding surface which extensions in thermal. As the solar flat plate buys seriously sizzling this glow is coordinated and consumed by the fluid spilling inside the copper tubes. The lines and shield plate are encased in an ensured metal else wooden box with aflat layer of frosting material, Glass on opposite to get the encased defend plate and make a securing air filling space. This covering material doesn't hold the solar atomic capacity to any huge degree and consequently most of the moving toward radiation is gotten by the obscured shield. The air opening between the plate and covering material catches this glow holding it back from moving endlessly by and by into the environment. The defend plate glow up, it moves warmth to the fluid inside the power yet it similarly loses glow to its ecological variables.

Design Description

Low and medium sunlight based warming frameworks utilized for homegrown and modern applications, for

example, water and space warming, ordinarily use solar powered level plate authorities to retain sun based nuclear power changing over it into warmth and afterward moving the warmth to a liquid (generally air or water) courses it. The mark of the investigation is survey the solar energy based controlled level of copper plate finder's capability and fluid lead inside the pipeline with three different cross portions, which pressing the factor driven distances across are 10, 5.14 and 6.18 mm, by using ansys analysis. The results got from the CFD analysis gadget shows the authority with the type one cross region showed up at thermal up to 340K at the line outlet getting a capability of 68.5%, higher than types two and three, which efficiency is 51% and 60% independently. Type one crosses the territory presented the most diminished characteristics at both speed and pressing factor drop, at the factors in 0.266m/s and 108.6pa, separately.

Modelling Methodology

The solid works is solid modeler, and utilizations a parametric part based approach to manage make models and assemblies. The item is formed on Para solid piece. Limits highlight objectives whose characteristics choose the shape or figuring of the model or assembling. Limits are in numeric, for ex: concentric, circle, line, mathematical limits vertical etc. The limits can be connected with each other utilizing relations, which licenses them to get plan objective. Plan assumption is the way of the producer of the part gets it to respond to updates and changes. For example, you would require the opening at the most worth place of a beverage can to stay at the top surface. Solid works grants the customer to show that the opening is a component on the top surface, and will by then honor their arrangement. Features suggest the design square of parts. Movement based features are not sketch based and fuse features like draft, shells, filets to the substances of a part, etc. The creation of solid works model generally speaking starts with 2D sketch. The sketch includes lines, curves and splines. Coordination are used to describe the properties like oppositeness, intersection etc. Additionally as describe conditions like crossroads, concentricity with respect to draw math, gathering mates portray equivalent relations concerning the individual parts or fragments, allowing the basic advancement of assemblages. SolidWorks similarly consolidates extra advanced mating features, for instance, stuff and cam lover mates, which grant showed stuff social events to definitely rehash the rotational improvement of a genuine stuff train.

Designing and Analysis Procedure

Existing Model



Fig. 1.The Parallel Flow Passages Are Created Using Extrude Tool



Fig. 2.The passages are connected with two perpendicular pipes at their ends extrude tool

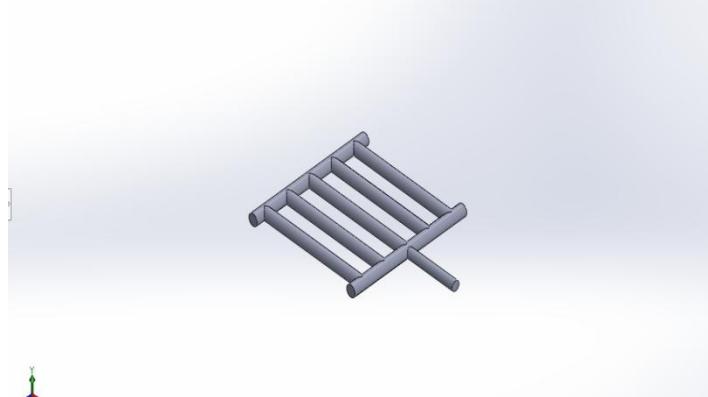


Fig. 3.Inlet passage created at mid portion of inlet zone using extrude tool

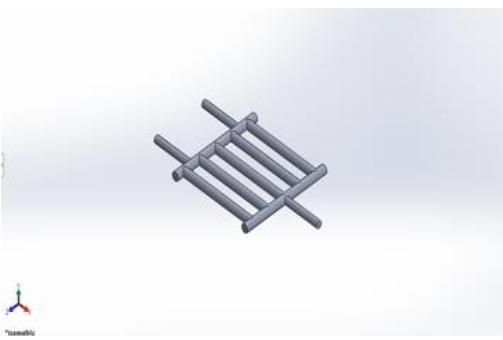


Fig. 4.Two exhaust passages are created at the exhaust zone using extrude and mirror tool

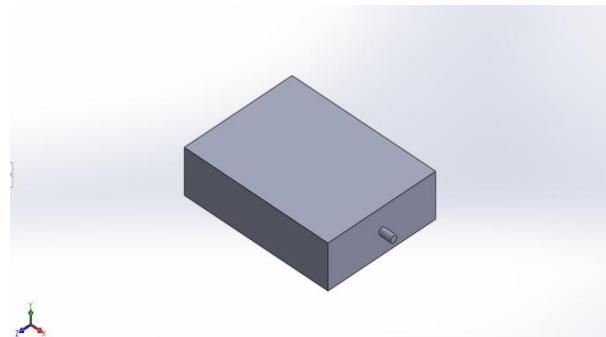


Fig. 5.The enclosure to house the pipe is created with the help of extrude tool and forms the complete model of solar flat plate collector existing model

Flow Passage with Larger Pipe Diameter



Fig. 6.The flow passage pipe is created using sweep tool

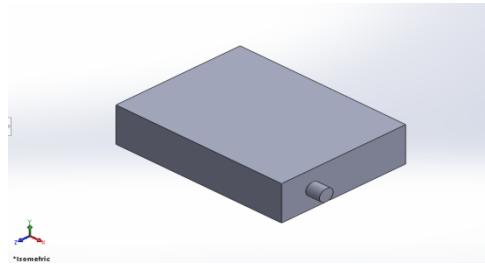


Fig. 7.The enclosure to house the pipe is created with the help of extrude tool and forms the complete model of solar flat plate collector with larger passage diameter

Flow Passage with Smaller Pipe Diameter

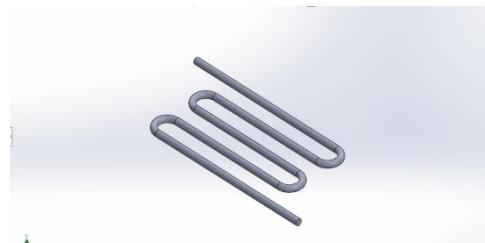


Fig. 8.The flow passage pipe is created using sweep tool

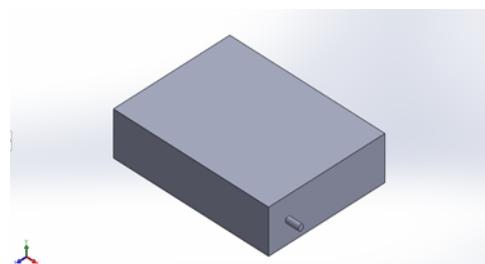


Fig. 9.The enclosure to house the pipe is created with the help of extrude tool and forms the complete model of solar flat plate collector with smaller passage diameter

Design Analysis

This part is proposed as an initial guide for Computational Fluid Dynamics CFD. Because of its initial nature, just the essential standards of CFD are presented here. For more nitty gritty depiction, peruses are alluded to different course readings, which are committed to this CFD gives mathematical conjecture to the conditions that control smooth development. Use of the analysis of CFD to examine a fluid issue requires the going with advanced. In any case, the mathematical conditions depicting the fluid stream are formed. These are by and large a lot of mostly various conditions. Finally, the hidden conditions and the cutoff conditions of the specific issue are used to address to the conditions. Besides, certain control limits are used to control the blend, strength, and accuracy of the procedure. All

CFD codes contain three rule segments: a pre-processor, which is used to enter the troublesome figuring, produce the cross section, and portray the stream limit and the quantity conditions to the code. The stream is addresses by administering conditions gave.

Results of Existing Model of Solar Flat Plate Collector

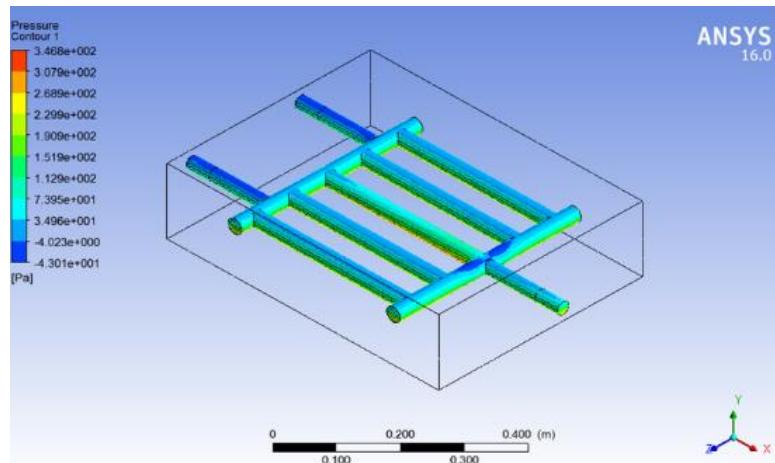


Fig. 10. Pressure distribution on the flow passage

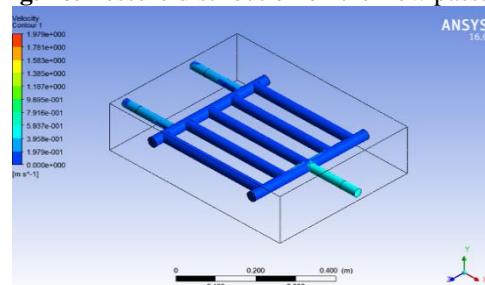


Fig. 11. Velocity distribution on flow passage

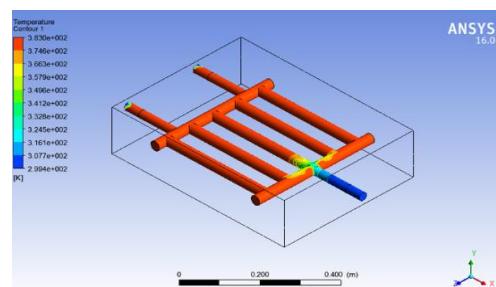


Fig. 12. Temperature distribution on flow passage

Results of Smaller Pipe Flow Passage Solar Flat Plate Collector

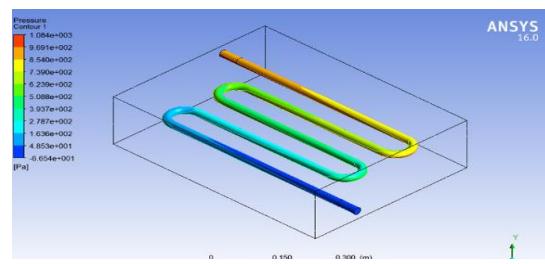


Fig. 13. Pressure distribution on the passage

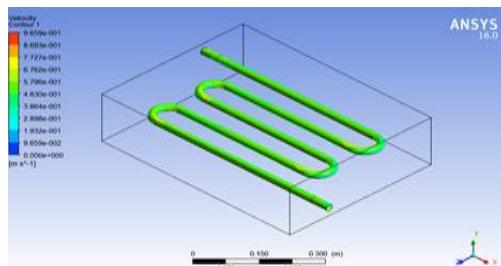


Fig. 14. Velocity distribution on the flow passage

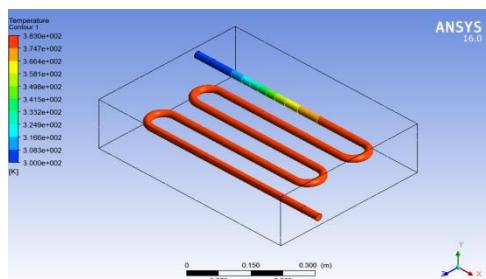


Fig. 15. Temperature distribution on flow passage

Results of Larger Pipe Flow Passage Solar Flat Plate Collector

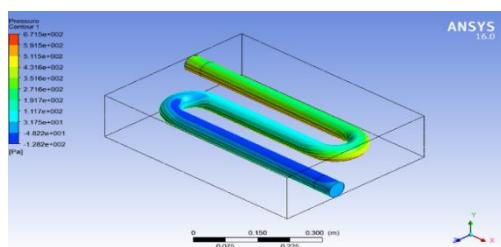


Fig. 16. Pressure distribution on the flow passage

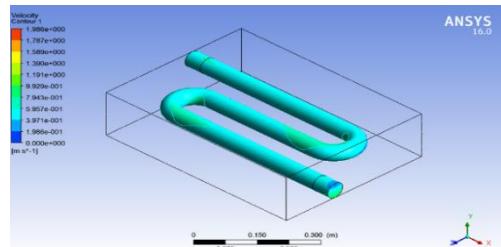


Fig. 17. Velocity distribution on the flow passage

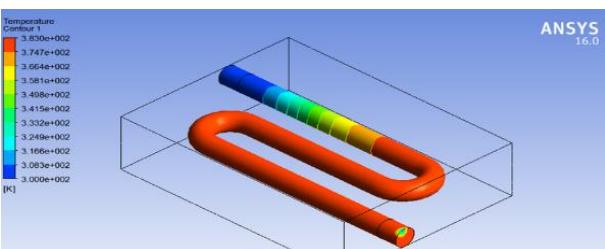


Fig. 18. Temperature distribution on flow passage

Tabulate Result

Model	Pressure (pa)		Velocity (m/s)		Temperature (k)	
	Min	Max	Min	Max	Min	Max
Existing	-4.3e1	3.46e2	0	1.97	2.99e2	3.83e2
Smaller pipe	-6.65e1	1.08e3	0	9.65e-1	3e2	3.83e2
Larger pipe	-1.28e2	6.71e2	0	1.98	3e2	3.83e2

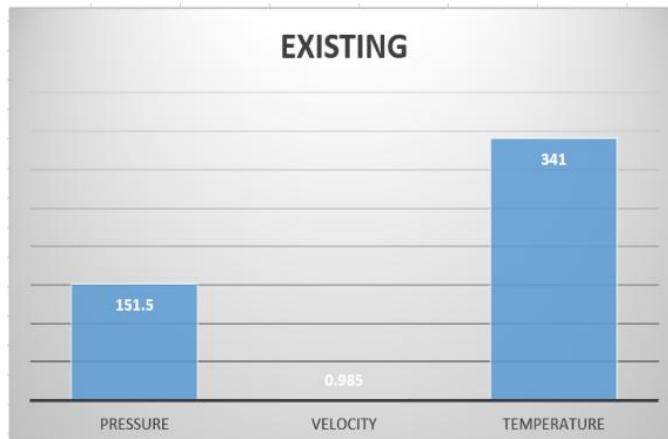


Fig. 19. Pressure, velocity, temperature distribution of existing model

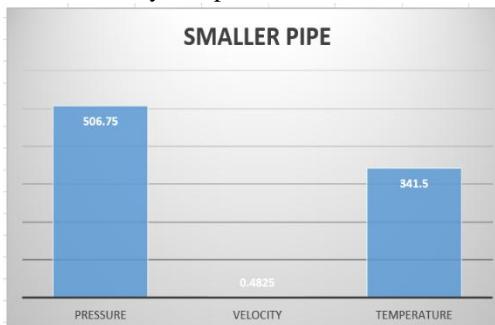


Fig. 20. Pressure, velocity, temperature distribution of Smaller pipe

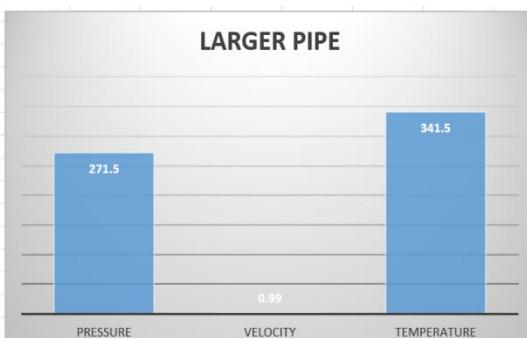


Fig. 21. Pressure, velocity, temperature distribution of larger pipe

Justification Journey

1. The solar flat plate conditions apply on flow pressure and temperature distribution.
2. Comparison between existing model shows that the variations of smaller pipe were quite satisfactory in the outlet pressure and temperatures.
3. The results of spiral pipes also matches with the existing model there by the design lies in the satisfactory limit.

4. While comparing with large and small diameters, the flow travel time is higher in smaller diameter pipe.
5. Hence, future needs the involvement of spiral pipe with smaller diameter with increased number of turns.

Conclusion

A mathematical tabulation of the stream and temperature dispersion in a solar light based on their performed. The CFD model was approved by estimations with the solar powered gatherer with existing stream section setups. While comparing with large and small diameters, the flow travel time is higher in smaller diameter pipe. Hence, future needs the involvement of spiral pipe with smaller diameter with increased number of turns. Thus by implementing the flow passage models of spiral pipes the tedious fabrication complexity can be reduced. The results of spiral pipes also matches with the existing model there by the design lies in the satisfactory limit. While comparing with large and small diameters, the flow travel time is higher in smaller diameter pipe when compared with larger diameter. Hence the maximum heat conduction can be happened when compared with larger diameter. Hence for the future involvement the spiral pipe with smaller diameter with increased number of turns as per the user requirement is concluded.

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