



Enhancement of Heat Transfer Performance For Parabolic Trough Solar Collector with Pin Fin Arrays Inserting

Mukesh Dhar Dubey¹, Amit Kumar²

M.Tech Scholar¹, Assistant Professor², Department of Mechanical Engineering
Patel College of Science and Technology Ratibad Bhopal(M.P.)

Abstract

Heat dissipation is one of the main problems which we come across while dealing with high load and high speed machines. Because of the work they perform, some amount of heat is generated inside the machine. This heat has to be transferred outside the system to obtain efficient output. If it is not done, then this heat may cause damage to machine parts. To do this, fins are used. Main purpose of fins is to increase surface area of machine so that heat can be transmitted in atmosphere. Tube receiver with pin fin arrays inserting was introduced as the absorber tube of parabolic trough receiver to increase the overall heat transfer performance of tube receiver for parabolic trough solar collector system. The Monte Carlo ray tracing method (MCRT) coupled with Finite Volume Method (FVM) was adopted to investigate the heat transfer performance and flow characteristics of tube receiver for parabolic trough solar collector system.

Keywords: Solar energy, Parabolic trough collector, Tube receiver, Heat transfer enhancement, Finite volume method, Monte Carlo method

Introduction

Solar energy utilization is one of the most effective ways for facing the recent problems in the energy domain which are associated with the global warming, the fossil fuel depletion and the increasing rate of electricity price. Solar energy is abundant energy source which can either be converted into useful heat and to electricity, the fact that makes it a suitable energy source for numerous applications from domestic hot water production to solar dryers and to electricity production in concentrating solar power plants.

Concentrating solar collectors are the most suitable technology for operation in medium and high-temperature levels (over 150°C) with high thermal efficiency. Among the developed technologies, parabolic trough collector (PTC) is the most mature solar collector type which is used in many applications. PTCs usually operate with thermal oils as Dowtherm, Therminol, Syltherm and Sandotherm, while the last years' applications with molten salts (mainly nitrate salts) have been developed. Thermal oils can operate with safety up to 400°C, while molten salts usually up to 550°C. For achieving higher temperature levels, liquid metals as liquid sodium and gas working fluids (air, carbon dioxide, nitrogen and helium) can be utilized. At this time, the majority of thermal applications with PTC uses thermal oils, as Therminol VP1 and Syltherm 800 because these are the most common and reliable solutions the last years, many techniques have been examined for improving the thermal performance of PTCs. The basic goal of these techniques is to improve the heat transfer conditions between absorber and fluid, increasing the

ISSN 2454-308X

