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Effect of non-uniform temperature distribution on entropy generation and enthalpy for the laminar developing pipe flow of a high Prandtl number fluid

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ABSTRACT

In this article, Entropy generation and enthalpy are investigated on the pipe wall in developed laminar flow for 7 cases. Variation of entropy generation and enthalpy are shown along the radius. Entropy generation and enthalpy along the radius are obtained. Heat transfer is increased with the flow of fluid through the pipe, in inlet of pipe points to the output. The amount of entropy generation in the pipes of higher temperature is more than other points. Enthalpy is proportional to temperature in surface variation of 7 cases. In the points of higher temperature in elementary cases, the enthalpy value is increasing and it is increasing in other cases. Fluctuations of enthalpy and entropy generation are producted in interface points of pipe surfaces. The diagram data can be used to measure the minimum entropy generation in pipe heat transfer. Minimum entropy generation is in surface whit high temperature. The enthalpy in centerline is constant and inlet enthalpy of the tube is greater than other point with higher temperatures in radial flow. The lowest enthalpy is obtained in tubes with lowest initial temperature (case 7). Minimum entropy generation is presented in surface whit high temperature at the beginning (case 1-3) or high at the ending (case 5-7).

1. Introduction

Pipes are used in different environments with environment temperature and pipe wall temperature variation in industry. In this work, distribution of temperature on the pipe is studied in different conditions. Boundary conditions are simulated for uniform temperature. The amounts of entropy generation and enthalpy are investigated radially and axially. Minimum entropy generation and enthalpy are cased in the pipe the most economic efficiency in industry. Theoretical and experimental studied temperature distribution and flow profile in evacuated tube solar collector, based on the boundary conditions of solar radiation are studied by Essa et al. [1]. Uses of non-uniform temperature distribution in pipes for several cases were showed [2, 3]. Clear calculations, temperature distribution, according to the absorber pipe, were checked and tested [4, 5]. Temperature distributions are investigated due to the similarity of pipes and channels mechanisms of channels in several cases [6-14]. Temperature distribution monitoring of a coiled flow channel in microwave heating using an optical fiber sensing technique are tested by Wada, et.al. [7]. Temperature distribution monitoring of a spiral flow channel in microwave heating using an optical fiber sensing technique by Irfan, et.al were tested [8]. Experimental simulation and CFD of temperature distribution of fluid flow and heat transfer in natural circulation of passive cooling system of an advanced nuclear reactor were provided by Pal, et.al.[15]. Natural convection in a porous rectangular enclosure with sinusoidal temperature distribution on both sides of the wall using a non-thermal equilibrium model was studied by Wu, et.al.[16]. Experimental study on startup and thermal performance in high temperature insulation for pipes and cylindrical screen was offered by Wang, et al. [17]. Experimental study on the simultaneous measurement of temperature distribution and irradiative properties of oil-fired tunnel kiln were showed by Lou, et al. [18]. Development of semi-empirical model for uniform distribution of temperature in heat exchanger

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