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Heat Transfer and Entropy Generation in a Partial Porous Channel Using LTNE and Exothermicity/Endothermicity Features

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Abstract : This work aims to provide a comprehensive study on the heat transfer and entropy generation rates of a horizontal channel partially filled with a porous medium which experiences internal heat generation or consumption due to exothermic or endothermic chemical reaction. The focus has been given to the local thermal non-equilibrium (LTNE) model. The LTNE approach helps us to deliver more accurate data regarding temperature distribution within the system and accordingly to provide more accurate Nusselt number and entropy generation rates. Darcy-Brinkman model is used for the momentum equations, and constant heat flux is assumed for boundary conditions for both upper and lower surfaces. Analytical solutions have been provided for both velocity and temperature fields. By incorporating the investigated velocity and temperature formulas into the provided fundamental equations for the entropy generation, both local and total entropy generation rates are plotted for a number of cases. Bifurcation phenomena regarding temperature distribution and interface heat flux ratio are observed. It has been found that the exothermicity or endothermicity characteristic of the channel does have a considerable impact on the temperature fields and entropy generation rates.

Keywords : entropy generation, exothermicity or endothermicity, forced convection, local thermal non-equilibrium, analytical modelling
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