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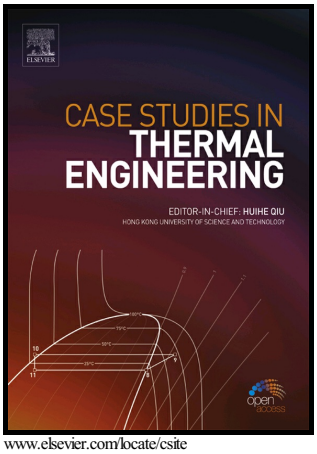

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Hybrid semi analytical method for geothermal U shaped heat exchanger

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Abstract

In this paper, convective-conductive heat transfer processes between the all components of geothermal borehole heat exchanger (BHE) such as pipe-in, pipe-out and grout have been studied. A set of coupled partial differential equations subjected to general initial and boundary conditions are governed to this problem. Modified Homotopy perturbation method (MHPM) is a hybrid of discrete Fourier Transform, spectral analysis and Homotopy Perturbation Method that is developed in order to solve the partial differential equations of geothermal borehole systems. The results of MHPM are compared with the numerical solution for validation and, furthermore, the effectiveness and accuracy of the applied method have been shown.

Keywords: Borehole heat exchanger, Heat conduction-convection, Discrete Fourier transformation, Homotopy perturbation method

Nomenclature

i	Tube in
o	Tube out
g	Grout
L	Borehole length
u	Fluid velocity
ρ	Fluid density
c	Specific heat of the fluid
λ	Fluid thermal conductivity
λ_g	Grout thermal conductivity
c_g	Grout specific thermal capacity
$b_{\alpha\beta}$	Thermal coefficient between two components
r_i	Inner radius of the pipe
r_o	Outer radius of the pipe