عنوان مقاله:

Analytical Simulation for Transient Natural Convection in a Horizontal Cylindrical Concentric Annulus

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نویسندگان:

A.S.J. Al-Saif - *Department of Mathematics, College of Education for Pure Science, Basrah University, Basrah, Iraq*

Takia Ahmed J. Al-Griffi - *Department of Mathematics, College of Education for Pure Science, Basrah University, Basrah, Iraq*

خلاصه مقاله:

In this study, a new scheme is suggested to find the analytical approximating solutions for a two-dimensional transient natural convection in a horizontal cylindrical concentric annulus bounded by two isothermal surfaces. The new methodology depends on combining the algorithms of Yang transform and the homotopy perturbation methods. Analytical solutions for the core, the outer layer and the inner layer at small times are found by a new method. Also, the effect of Grashof number, Prandtl number and radius proportion on the heat transfer and the flow of fluid (air) at different values was studied. Moreover, the study calculates the mean of the Nusselt number along with the effect of the Grashof number and radius proportion on it as parameters which acts as clues for heat transfer calculations of the natural convection for the annulus. The results, obtained by using the new method, prove that it is efficient and has high exactness compared to the other methods, used to find the analytical approximate solution for the transient natural convection in a horizontal cylindrical concentric annulus. The convergence of the new method was also discussed theoretically by referring to some theorems, and experientially by a verification of the solutions resulting from the simulations of the convergent condition. Furthermore, the graphs of the new solutions show the veracity, utility and exigency of the new method, and come in line with solutions offered by previous studies.

کلمات کلیدی:

Yang transform, Homotopy perturbation method, Natural convection, cylinder annulus, convergence analysis

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