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BOUNDARY LAYER FLOW AND HEAT TRANSFER OF CARBON NANOTUBES OVER A MOVING SURFACE IN PRESENCE OF HYDROMAGNETIC

(Aliran Lapisan Sempadan dan Pemindahan Haba dalam Karbon Nanotiub Terhadap Permukaan yang Bergerak dengan Kehadiran Hidromagnet)

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ABSTRACT

The aim of this study is to investigate and analyze the influence of hydromagnetic forces on the boundary layer flow and heat transfer of carbon nanotubes over a moving surface. Both types of carbon nanotubes such as single-wall carbon nanotubes and multi-wall carbon nanotubes are considered in this research with two types of base fluid, namely water and kerosene. The governing nonlinear partial differential equations are transformed into a nonlinear ordinary differential equations by using similarity transformations then solved numerically by implementing bvp4c package in MATLAB software. The results obtained were represented in table and graphically illustrated with different values of the moving parameter, magnetic parameter, and carbon nanotubes volume fraction parameter. Additionally, the graphs included in this research are skin friction coefficients and local Nusselt number besides the velocity profile and temperature profile. The results proved that duality solutions exist when the plate and the free stream move in opposite directions. Moreover, the availability of magnetic parameter causes the boundary layer thickness to become thinner and increase the heat transfer.

Keywords: nanofluid; carbon nanotubes; moving plate; hydromagnetic; dual solution

ABSTRAK

Kajian ini meneroka dan mengkaji kesan hidromagnet dalam aliran lapisan sempadan dan pemindahan haba karbon nanotiub terhadap permukaan yang bergerak. Kedua-dua jenis karbon nanotiub seperti karbon nanotiub berdinding tunggal dan karbon nanotiub dinding pelbagai dipertimbangkan dalam kajian ini dengan dua jenis bendalir asas, iaitu air dan kerosin. Persamaan pembezaan separa tak linear dijelmakan menjadi persamaan pembezaan biasa tak linear dengan menggunakan penjelmaan keserupaan yang kemudian diselesaikan secara berangka dengan melaksanakan pakej bvp4c dalam perisian MATLAB. Keputusan yang diperoleh diwakili dalam jadual dan digambarkan secara grafik dengan nilai berbeza bagi parameter bergerak, parameter magnet, dan parameter pecahan isipadu karbon nanotiub. Selain itu, graf yang disertakan dalam kajian ini ialah pekali geseran kulit dan nombor Nusselt selain profil halaju dan profil suhu. Keputusan membuktikan bahawa penyelesaian dual wujud apabila plat dan aliran bebas bergerak dalam arah bertentangan. Selain itu, kewujudan parameter magnet menyebabkan ketebalan lapisan sempadan menjadi lebih tipis dan meningkatkan pemindahan haba.

Kata kunci: bendalir nano; karbon nanotiub; permukaan yang bergerak; hidromagnet; penyelesaian dual

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