Dual numerical solutions on mixed convection casson fluid flow due to the effect of the rate of extending and compressing sheet – stability analysis

ABSTRACT

Numerical model of mixed convection boundary layer flow, heat and mass transfer beyond an extending or compressing sheet are developed by Mathematicians in the field of Applied Mathematics Fluid Dynamics. Most of the numerical results can be used as a comparison with the results by experimental works. In the numerical model of mixed convection with extending and compressing sheet, there is high possibility to achieve dual solutions. One of the solutions is stable, reliable and really occur in actual fluid mechanism. Meanwhile, another solution is unstable, unreliable and rejected. According to this statement, the dual numerical solutions of mixed convection Casson fluid flow, which is subjected to the rate of extending and compressing sheet is reported in this paper. The extending rate is denoted as positive values, otherwise it is declared as compression of the sheet. The usage of similarity variables is to perform the conversion from partial differential equations (PDE) to ordinary differential equations (ODE). The PDE are formed from the equations of momentum, energy and concentration. Finally, ODE are solved numerically by bvp4c program in Matlab software. Stability analysis is performed to deal with dual numerical solutions, which select the most stable solution and physically reliable. The numerical results of velocity, temperature and concentration are presented, subjected to the governed parameters in the modelled problem. As a conclusion, the variations of velocity, temperature and concentration against boundary layer thickness are fully affected by compressing and extending parameters.

Keyword: Casson fluid; Extending/compressing sheet; Dual solutions; Stability analysis