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Stability Analysis of The Stagnation-Point Flow and Heat Transfer Over a Shrinking Sheet in Nanofluid in The Presence of MHD and Thermal Radiation

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ABSTRACT

Recent developments in the field of fluid dynamics have led to a new interest in stability analysis. The numerical solution obtained from the problems of the flow at the stagnation point, as well as the heat transfer with MHD and thermal radiation effects over a shrinking sheet, is used to carry out a stability analysis. The flow of this problem is considered in nanofluids and Buongiorno's model is employed. The boundary layer equation is obtained by reducing the governing equations to an ordinary differential equation. Partial differential equations are converted to ordinary differential equations using a suitable similarity transformation. The bvp4c simulation on Matlab is then used to solve ordinary differential equations. According to the numerical data, the dual solutions occur in a specific range of α. The parameter α refers to the stretching/shrinking where shrinking (less than 0) is the main reason the dual solution exists. The stability analysis is presented graphically and in tabular form to prove that there are two solutions to the problem and only one of them is stable. As a result, our research shows that the solution is only stable in the first solution, but not in the second.

1. Introduction

Research on heat transfer problems is important for applications in industries and engineering, as reported by Oo *et al.,* [1], Idris *et al.,* [2], Jahan *et al.,* [3], Pasha *et al.,* [4] and Halim and Sidik [5]. However, if non-unique solutions occur in calculations, it is important to verify the stability of the solutions. There are some considerations that lead to the dual solution of some problems, such as in the unsteady case, mixed convection, moving surface and stretching or shrinking surface in boundary layer flow. So far, only this condition that affects the dual solution occurs in the literature review, and some existences occur only under certain conditions. For example, in certain cases, to gain the

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