

The stagnation-point flow towards a shrinking sheet with homogeneous – heterogeneous reactions effects: A Stability Analysis

Nurul Syuhada Ismail^{1,a)}, Norihan Md Arifin^{1,2,b)}, Norfifah Bachok^{1,2, c)} and Norhasimah Mahiddin^{3, d)}

¹*Institute for Mathematical Research, Universiti Putra Malaysia, 43400 UPM Serdang Selangor, Malaysia*

²*Department of Mathematics, Faculty of Science, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia*

³*Centre of Foundation Studies for Agriculture Science, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia.*

^{a)}syuhada.polaris@gmail.com

^{b)}norihana@upm.edu.my

^{c)}norfifah@upm.edu.my

^{d)}norhasimahmahiddin@upm.edu.my

Abstract. A numerical study is performed to evaluate the problem of stagnation – point flow towards a shrinking sheet with homogeneous – heterogeneous reaction effects. By using non-similar transformation, the governing equations be able to reduced to an ordinary differential equation. Then, results of the equations can be obtained numerically by shooting method with maple implementation. Based on the numerical results obtained, the velocity ratio parameter $\lambda < 0$, the dual solutions do exist. Then, the stability analysis is carried out to determine which solution is more stable between both of the solutions by bvp4c solver in Matlab.

Keywords: dual solutions, shrinking sheet, stability analysis, homogeneous, heterogeneous

INTRODUCTION

There exists two types of chemical reaction which are homogeneous and heterogeneous processes. Homogeneous process is the one that occurs either in bulk or fluid while heterogeneous happens on the same catalytic surface. Catalysis, biochemical systems and combustion are the examples of numerous chemical reacting systems contain for both homogeneous and heterogeneous reactions. A simple model in boundary-layer flow for homogeneous - heterogeneous reactions has been first considered by Chaudhary and Merkin[1]. They gave the model of homogeneous reaction is isothermal cubic kinetics and heterogeneous reaction by first order kinetics. Later on, Chaudhary and Merkin[2] continue their study by including the loss of auto catalyst effect. Merkin[3] was considering the Blasius similarity solution for the isothermal homogeneous - heterogeneous reactions problem. Then, the problems of the fluid flow in the interest of homogeneous - heterogeneous reaction have been reported by