UNIVERSITI TEKNOLOGI MARA

TECHNICAL REPORT

MATHEMATICAL MODELLING OF BURGER'S EQUATION APPLIED IN TRAFFIC FLOW

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Report submitted in partial fulfillment of the requirement for the degree of
Bachelor of Science (Hons.) Mathematics
Center of Mathematics Studies
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JULY 2016

ACKNOWLEDGEMENTS

IN THE NAME OF ALLAH THE MOST GRACIOUS, THE MOST MERCIFUL.

Alhamdulillah, we are grateful to Allah S.W.T for giving us the strength to complete this project successfully. This final year project was prepared for Faculty of Computer Science and Mathematics, MARA University of Technology (UiTM). Basically for final year student in order to complete the undergraduate program that leads to the degree of Bachelor of Science (Hons) Mathematics. This report is based on the methods given by the university.

We profoundly express gratitude to our Supervisor, Associate Professor Madya Dr. Jusoh Yacob, for him keen interest on our project and for guiding us all along until this project is completed successfully. We sincerely thankful for this supervision whose encouragement, guidance and support from the beginning to the end of the semester which enabled us to develop understanding about this project. His passion for excellence and meaningful insight was inspiring and unrivalled which has been a huge contribution in achieving the mission and vision of this project. We would also like to thank our lecturer of Mathematics Project (MAT 660), Madam Wan Khairiyah Hulaini bt Wan Ramli, for her advice and guidance.

Last but not least, we would like to express our appreciation to our families and friends for theirs support and encouragement in completing this project.

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ABSTRACT

Burger's equation is a nonlinear partial differential equation occurring in various areas of applied mathematics, one of that is traffic flow. Burger's equation is the simplest equation combining both nonlinear propagation effects (uu_x) and diffusive effects (u_{xx}). We interest to find the solution of inviscid and show the derivation of viscid by using Cole-Hopf transformation. In order to apply Burger's equation in traffic flow, effort will concentrate to obtain the solution. Throughout research for Burger's equation, we find the way to derive Navier-Stokes equation, to derive inviscid Burger's equation. We also show the derivation of Cole-Hopf transformation for viscid Burger's equation. Lastly, we apply any function of inviscid Burger's equation as a model traffic Flow. Beside that, we also get the solution of one-way traffic flow by using the method of linear system.

1 INTRODUCTION

1.1 BACKGROUND OF BURGER'S EQUATION

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In Wikipedia (2015) fluid, nonlinear acoustics, gas dynamic and traffic flow are one of the Burger's equation occurs in various areas of applied mathematics in a nonlinear partial differential equation. Johannes Martinus Burgers (1895-1981) the name given in conjunction with the Burger's equation. To get general form for Burger's equation in disappear system is by one dimensional space. It is known as viscous (viscid) Burger's equation. When the diffusion term is absent, Burger's equation becomes an inviscid Burger's equation.

$$\frac{\partial u}{\partial t} + u\frac{\partial u}{\partial x} = d\frac{\partial^2 u}{\partial x^2} \tag{1}$$

where $u(x,t)$ is a velocity and d is diffusion coefficient or viscosity.

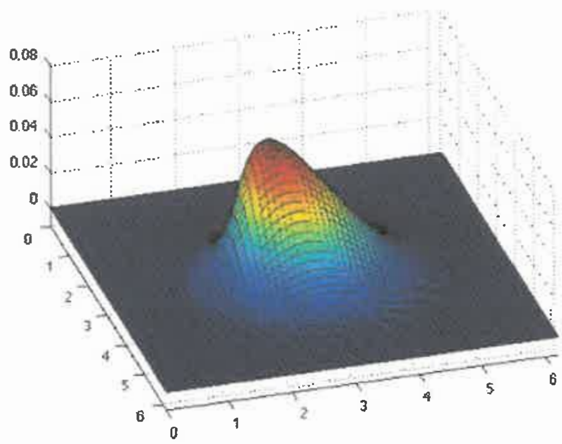

Figure 1.1: This is a numerical simulation of the inviscid Burgers Equation in two space variables up until the time of shock formation.