UNIVERSITI TEKNOLOGI MARA

TECHNICAL REPORT

THE STUDY OF PARACHUTE PROBLEM

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

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ABSTRACT

In the skydiving problem, parachute is used to slow down the motion of skydiver for the safe landing. The shape of parachute's canopy play importance role to determine the speed of down motion of the skydivers. The more the air resistance occur at the parachute's canopy the slower the speed of the skydivers. Therefore, this project used difference types of shape of the parachute's canopy which are three dimensions and two dimensions that determine the air flow against its and also related to the values of drag coefficient. This project has the traditional equation for parachute problem and going to use the application of Buckingham π Theorem to derive the drag coefficient of equation for improved of the parachute problem. By solving the improved of the parachute problem equation, the actual values by analytically solution of the velocity can be determined. In addition, Fourth Order Runge Kutta method (RK4) also use in this project to find the approximation solution due to its high accuracy rather that other numerical solution. This project would like to compare the analytical and numerical solution by calculate the error between this two method. Other than that, by comparing the values, this project know that whether the numerical solution method is suitable or not to use for solve the parachute problem. Based on this project findings, the value of error that had been calculated was quite large, therefore this project was testing with the smaller step size in reducing the error so that the numerical solution method can be used to solve the parachute problem.

1 INTRODUCTION

1.1 Research Background

The primary objective of this project is to compare the actual values and the approximation values of the velocity for the safe landing of skydivers. A skydiver begin a jump at a specific height by using a parachute and falls towards the earth under the influence of the gravity. There is the force which is the air resistance acted proportionally to the velocity of the skydivers. The air resistance is different when the parachute is closed or at free falls situation with the open parachute. However, this project is ignored the air resistance of free fall but only considered the air resistance when the parachute is opened. The traditional model of parachute problem analysis is presented below and the improvement model based on the traditional model are developed thus analyzed.

There are difference air resistances that flow in difference shape of parachute's canopy. The values of the air resistance is depending on the shape of parachute's canopy and form a difference value of drag coefficient, C_d. This project going to use the difference coefficient of drag but the other variables will be constant. In addition, there are certain factors that contributes to the improvement of model of parachute problem which are Buckingham π Theorem and the drag force. The equation of drag coefficient C_d is derived from the Buckingham π theorem to improve the parachute problem.

From the past findings, the suitable velocity for the safe landing is in range about 4 m/s^2, so this project is going to estimate the error for the safety landing by calculate the actual model and approximate model. The most suitable approximation model of the parachute problem is Fourth Order Runge Kutta Method (RK4) just because it less computational requirement and high accuracy. Fourth Order Runge Kutta Method (RK4) is used to solve higher order ordinary differential equation control by step size. Fourth Order Runge Kutta Method (RK4) is most approximate method compare to other numerical method but it still have error. In fact, RK4 is