UNIVERSITI TEKNOLOGI MARA

TECHNICAL REPORT

COMPARING METHOD IN DOUBLE PENDULUM

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

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ABSTRACT

In this project paper, its present the motion of the curves in double pendulum by comparing the three types of method that related each other. The method that used in double pendulum are Lagrangian, Euler equation, Hamilton's and lastly Runge Kutta. This method are related each other because to derive the Euler equation, formula of Lagrangian is needed and also from Euler equation, it can derive into two types of method such as Hamilton's and Runge Kutta but Runge Kutta can also derive from Hamilton's. All this method are needed to know their motion, structure of wave, and so on. Mathematica software is needed for solving the problem of double pendulum and to get the accurate result based on graph of parametric and for animation, it is shows their movements. This software can solve all this method included Lagrangian.

1 INTRODUCTION

Pendulum that attach with another pendulum is called double pendulum. The area of dynamical system in physic and mathematics, a rich dynamic behavior of a strong sensitivity is exhibits from the double pendulum of simple physic system with initial conditions. Double pendulum have a difference types whether same mass or different mass that declare as m_1 and m_2 and same length or different length that declare as L_1 or L_2. Its also have different angles. In Stickel (2009), a diagram of a double is shown in Fig. 1.1. The

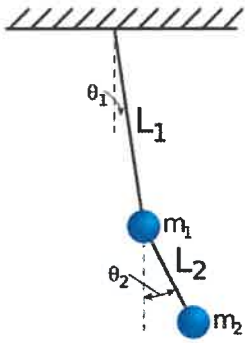

Figure 1.1: Double Pendulum

conservative system happens when double pendulum is friction-less that allows a conservation of energy, that is $Energy_{in} = Energy_{out}$. Furthermore, Stickel (2009) mentioned that double pendulum is two masses attached to rigid, mass less, rod with the base at a stationary location . In other words, the double pendulum become a linear system when angle is small and become non linear when angle is big.

To predict the behavior of double pendulum is very limited in certain regimes that is initial condition because the extreme sensitivity towards even small perturbations. In addition, Nielsen & B.T. (2013) said that the double pendulum is considered as a model system exhibiting deterministic chaotic behavior and the motion is governed by a set of