UNIVERSITI TEKNOLOGI MARA

TECHNICAL REPORT

THE MATHEMATICAL MODELLING OF SHALLOW WATER WAVE: KORTEWEG DE VRIES EQUATION (KDV)

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

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ABSTRACT

In this report, the study have been conducted on a nonlinear waves equation, Korteweg-de Vries (KdV), arising in mathematical modelling and the investigating existence of solutions to these equation using variational methods. In particular, the traveling wave solution is known as solitary waves.

The focus is on the derivation of the Korteweg-de Vries equation and the solution for these equations. For methodology, there are two methods that have been used which are exact equation to the Kdv Equation using D'Alembert Method and Exact Solution with Backlund transformation (Bilinearization).

Exact equation to the KdV equation using D'Alembert method are leads to two waves represents by $f(x-ct)$ which is a wave that move towards right with speed c and $f(x+ct)$ which is wave that move towards left with speed c.

Next, the method is Backlund transformation. By using this method it provides the approach to the theory of solitary wave. The arbitrary function is used to obtain the dependent variable transformation.

After that the next step is to get the two soliton solutions by using the mathematica code.The method of Backlund transformation create a non-linear equation presenting the soliton solution.The KdV equation is rewritten in a bilinear form in order to find the Backlund transformation for equation KdV.

To obtain the result, maple code are being used. Maple are being used to plot the graph of one soliton and two soliton solution waves. It has been plotted in 2d graph. For the conclusion, there is comparison between D'Alembert method and Backlund Transformation method to determine which method is more easier.

1 INTRODUCTION

Waves are one of the most fundamental motions: waves on the water's surface and of earthquakes, waves along springs, light waves, radio waves, sound waves, waves of cloud, waves of crowds, brain waves, and so forth (Toda, 1989).

Waves are recorded and analyzed. In the case of sound waves and light waves, it is customary to analyze a wave as the sum of simple sinusoidal waves. This is the principal of linear superposition.

However, when water waves are being observed carefully, the linear superposition principle cannot be applied in general, except for very small amplitudes. The study of water waves of finite amplitude was one of the main topics.

According to article from Wikipedia (2014), in fluid dynamics, dispersion of water waves generally refers to frequency dispersion, which means that waves of different wavelengths travel at different phase speeds.

Other than that, according to the article in Star online the flood that occurred in Kelantan such as Kuala Krai,Pasir Mas, Tanah Merah and others were the worst flood in 2014. According to Robinson (2014) when a head storm develop and moves downstream,then a rapid rise of water in a creek was occurs that we called flood wave .These was happened in Kuala Krai and many things were destroyed caused of the flood.