

UNIVERSITI TEKNOLOGI MARA

TECHNICAL REPORT

**STEADY STATE FLOW ON SHALLOW WATER EQUATION
WITH TOPOGRAPHY USING NEWTON-RAPHSON AND
IMPROVED SECANT METHOD**

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ABSTRACT

The shallow water equation (SWE) also known as Saint-Venant system is a system of hyperbolic partial differential equations. This equation has been widely used in solving the shallow water problem such as the steady state flow of fluid. A steady state flow of fluid might have an impact on factors such as bottom topography. This condition is encountered as the problem in preserving the steady state water flow with presence of bottom topography. In this research, one-dimensional (1D) SWE which in partial differential equations is considered for modelling due to the capability in solving the steady flow problem in an open channel. Since the complexity of 1D SWE, this research gives a solution by simplifying the 1D SWE to a cubic equation. Thus, the cubic SWE was applied in finding the approximate root using an iterative method which contributes to finding the values of water depth for solving steady state SWE. Then, the velocity of water flow was determined using values of water depth obtained. This study also evaluates the number of iterations to determine the best method that gives the fewest iterations in converging to the exact solution up to specified error tolerance. The root finding method which is an iterative method such as Newton-Raphson and Secant methods also compared to improvised Secant method is applied to solve the cubic SWE. As a result, the Three-point Secant method outperforms the Newton-Raphson and Secant methods in terms of efficiency in the fewest iteration. Furthermore, this study indicates that the values of water depth and velocity obtained have insignificant change from the initial condition, resulting in the preservation of steady-state water flow in the presence of topography.