UNIVERSITI TEKNOLOGI MARA

TECHNICAL REPORT

SOLVING LINEAR AND NONLINEAR HOMOGENEOUS DIFFUSION EQUATIONS BY USING HOMOTOPY PERTURBATION METHOD

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ABSTRACT

In this project paper, Homotopy Perturbation Method are applied to solve linear and non-linear diffusion equation. Homotopy Perturbation method have been applied to solved various problem in the past which yield a very accurate solutions. The working of linear and non-linear diffusion equation by using HPM are discussed clearly in order to obtain the analytical results. Comparison is made between results of Homotopy Perturbation Method with the exact solutions to show the accuracy of the results by plotting graphs and computing the errors, thus proved the fact this techniques are very straightforward, simple and effective.

1 INTRODUCTION

1.1 Research Backgroud

Perturbation Methods give the most adaptable tools accessible in nonlinear analysis of engineering problems. They are always being modified and connected to more complex problems. Despite that Perturbation Methods have their own restrictions as well as other nonlinear techniques (Nayfeh & Mook, n.d.). In many cases, small value parameter in an equation is one of the presumption in Perturbation Method. For example in singularly perturbed partial differential equation $\varepsilon \frac{\partial U}{\partial t} + U \frac{\partial U}{\partial t} = F(x,t)$, small value parameter, ε exist in this equation. Based on Farshidianfar & Nickmehr (2009), this small parameter assumptions greatly restricts applications. According to Barari et al. (2008), the perturbation solutions generally based on consistently valid approximation as long as scientific parameter is small. In any case, we can't completely relies on upon the presumption that no criteria of small value parameter must present in an equation. Therefore, the validity of the approximation numerically and experimentally must be checked. Homotopy Perturbation Method (HPM) have been proposed in order to overcome this difficulties (Barari et al., 2008). Other than that, for the condition when the large value of perturb parameter exist, the validity of traditional perturbation method cannot be met, thus HPM is usually applicable (Shoghi & Tabeshpour, 2014).

Differential and integral linear and nonlinear equation was solved by Ji Huan He as he presented HPM in 1998 (Hemeda, 2012). In addition, for various kind of linear and nonlinear problems, HPM is significant and analytical method which presented by He in 1998 (Neamaty & Darzi, 2010). Hemeda (2012) states that, in order to overcome difficult problems, the mixing of traditional perturbation and Homotopy in Topology form persistently into simple problem, thus it can be answer easily. To avoid scope of linear and nonlinear problems in applied sciences HPM has a meaningful advantages because it does not need small value parameter in an equation. HPM is a mixing of Perturbation Method and Homotopy Method that wipes out the