Penerapan Metode *Forward Time Forward Space* (FTFS) pada Persamaan Air Dangkal Linear

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ABSTRAK

Pada penelitian ini, fenomena model Persamaan Air Dangkal dikaji menggunakan metode beda hingga *Forward Time Forward Space* (FTFS). Penelitian ini diawali dengan mengkaji penurunan Persamaan Air Dangkal, linearisasi Persamaan Air Dangkal, substitusi Persamaan Air Dangkal Linear ke dalam skema FTFS, penurunan syarat kestabilan, dan hasil simulasi sesuai dengan syarat kestabilan. Persamaan Air Dangkal diperoleh melalui proses penurunan Persamaan Konservasi Massa dan penurunan Persamaan Konservasi Momentum. Linierisasi Persamaan Air Dangkal dilakukan dengan cara mencari solusi konstan Persamaan Air Dangkal kemudian memberi gangguan kecil pada solusi konstan tersebut. Penurunan syarat kestabilan menggunakan analisa kestabilan Von Neumann. Hasil dari penelitian ini yaitu metode FTFS pada Persamaan Air Dangkal Linear, stabil untuk $u_0 < -\sqrt{gd_0}$ dan $\Delta t \leq \frac{\Delta x}{(-u_0+\sqrt{gd_0})}$. Simulasi yang ditampilkan akan stabil jika syarat kestabilannya terpenuhi, yaitu pada saat menggunakan nilai arus ke arah kiri (u_0 negatif). Akan tetapi walaupun stabil, hasil simulasinya belum tentu benar. Karena dimungkinkan adanya *error damping* pada saat nilai $\Delta t < \frac{\Delta x}{(-u_0+\sqrt{gd_0})}$.

Kata Kunci : Air Dangkal, Linear, FTFS, Kestabilan

Application of the Forward Time Forward Space (FTFS) Method to the Linear Shallow Water Equation

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ABSTRACT

In this study, the phenomenon of the Shallow Water Equation model was studied using a different method to Forward Time Forward Space (FTFS). This research begins by examining the reduction of the Shallow Water Equation, linearization of the Shallow Water Equation, the substitution of the Linear Shallow Water Equation into the FTFS scheme, decreasing the stability requirements, and the simulation results according to the stability requirements. The Shallow Water Equation is obtained through the process of decreasing the Mass Conservation Equation and decreasing the Momentum Conservation Equation. Linearization of the Shallow Water Equation is carried out by finding a constant solution to the Shallow Water Equation then giving small disturbances to the constant solution. Derivation of stability requirements using the Von Neumann stability analysis. The results of this study are the FTFS method on Linear Shallow Water Equation, stable for $u_0 < -\sqrt{gd_0}$ *and* $\Delta t \leq \frac{\Delta x}{(-u_0+\sqrt{gd_0})}$*. The simulation shown will be stable if the stability conditions are met, namely when using the current value to the left (negative* u_0*). However, even though it is stable, the results of the simulation are not necessarily correct. Because it is possible that there is a damping error when the value* $\Delta t < \frac{\Delta x}{(-u_0+\sqrt{gd_0})}$.

Keywords: Shallow Water, Linear, FTFS, Stability