

Estimation of Implicit Colebrook White Equation by Preferable Explicit Approximations in the Practical Turbulent Pipe Flow

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Abstract : In several hydraulic systems, it is necessary to calculate the head losses which depend on the resistance flow friction factor in Darcy equation. Computing the resistance friction is based on implicit Colebrook-White equation which is considered as the standard for the friction calculation, but it needs high computational cost, therefore; several explicit approximation methods are used for solving an implicit equation to overcome this issue. It follows that the relative error is used to determine the most accurate method among the approximated used ones. Steel, cast iron and polyethylene pipe materials investigated with practical diameters ranged from 0.1m to 2.5m and velocities between 0.6m/s to 3m/s. In short, the results obtained show that the suitable method for some cases may not be accurate for other cases. For example, when using steel pipe materials, Zigrang and Silvester's method has revealed as the most precise in terms of low velocities 0.6 m/s to 1.3m/s. Comparatively, Halland method showed a less relative error with the gradual increase in velocity. Accordingly, the simulation results of this study might be employed by the hydraulic engineers, so they can take advantage to decide which is the most applicable method according to their practical pipe system expectations.

Keywords : Colebrook-White, explicit equation, friction factor, hydraulic resistance, implicit equation, Reynolds numbers

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