DEVELOPMENT OF FLOW EQUATION IN ALLUVIAL CHANNELS

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Abstract

Gradually varied flow equation is mainly derived for the computation of the flow surface profile in rigid-bed channels. Considering the assumption that, in alluvial channels part of the energy is consumed in the motion of sediment particles, a modified equation is proposed to compute the water surface profile in mobile-bed channels. Three modification factors are considered, theoretically, to modify the usual gradually varied flow equation to be used in computation of flow profile in alluvial channels. These modification factors are thought to be dependent on a sediment characteristics parameter. Conceptual derivation of an alluvial flow equation verified the theoretical approach, considering an alluvial channel reach with a bed material layer of thickness δ_s as shown in figure (1), and taking into account the transporting energy head as a part of the energy dissipated in the reach.

The validity of the derived equation has been investigated using experimental data, which collected by a multi-university research-team at St. Anthony Falls Laboratory (SAFL) Cui et al (1996). The inverse of the sediment coefficient, $1/\phi$, was considered to have a range of values similar to values of angle of repose of the sediment material. The corresponding values of the sediment characteristic parameter, φ, were calculated. The computed value of the sediment characteristics parameter, φ, corresponding to each value of $1/\phi$, were substituted to test the validity of the alluvial flow equation, using Parasad (1970) algorithm. The variation in the computed water level for run 1 according to change in the values of $1/\phi$ is investigated. It is noticed that, as $1/\phi$, assumed angle of repose, increases the computed water level be closer to the measured water level, exploring the validity of the conceptually derived alluvial flow equation. A value of $1/\phi$ equal 35 was used to verify the derived alluvial flow equation for the other two runs of SAFL data. The conceptually derived alluvial flow equation is applied to the other two runs, run 2 and run 3 as verification runs.

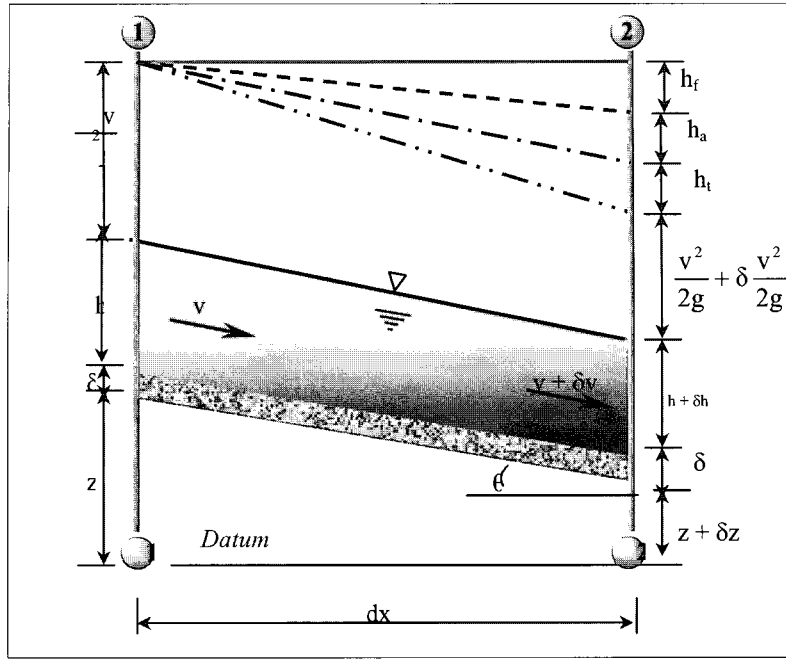

Fig. 1 Application of Energy Principle to Alluvial Channel

REFERENCES

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