A study on the derivation of a mean velocity formula from Chiu's velocity formula and bottom shear stress

Discussion by Renjie Xia

General Comments

According to the authors, the new mean velocity formula is derived as

$$\bar{u} = \frac{\bar{h}_\zeta \, g \, R \, l_f}{\nu F(M)}$$

where $\bar{h}_\zeta$ is the mean value of h_ζ (unit conversion factor), g the gravity acceleration, R the hydraulic radius, l_f the energy gradient, ν the kinematic viscosity, M the dimensionless entropy parameter, and F(M) = $\dfrac{(e^M - 1)}{[\dfrac{Me^M}{(e^M - 1)} - 1]}$

However, there is nothing new to me. The entire section of "Theoretical Background" looks like a copy of Chiu's works published many years ago. F(M) was initially defined by Chiu and Said (1995) as the equation (17) in their paper. Authors did not quote this paper in their references.

Specific Comments

Authors described that this study proposed a formula for estimating the mean velocity of river using factors easily obtainable from rivers including the unique hydraulic characteristics of a river such as area, width, wetted perimeter and river bed slope. Unfortunately, one of these hydraulic characteristics, l_f, is not easily obtainable. l_f is the energy slope which is totally different from the river bed slope, and is difficult to be obtained. If there is a measured value of l_f, using Manning's formula, $\bar{u} = \frac{1}{n} R^{\frac{2}{3}} \sqrt{l_f}$ (n - the Manning roughness), to estimate the mean velocity could be more convenient.

In actuality, a number of methods for estimating the mean velocity have been investigated during the last two decades. Using the entropy theory, Chiu (1987, 1988, 1989, and 1991) derived the mean velocity as

$$\bar{u} = \left(\frac{e^M}{e^M - 1} - \frac{1}{M}\right) u_{\max} = \Phi(M) u_{\max}$$

and described that the mean velocity can be expressed as a linear function of the maximum velocity.

Xia (1997) found that the relation between the mean and maximum velocities was perfectly linear along both straight reaches and river bends for the Mississippi River in USA. Similar findings were obtained by Moramarco et al. (2004) and Moramarco and Singh (2008) for the upper Tiber River in Central Italy. This suggests that M might represent an intrinsic parameter not only of the equipped site but also of the river reach where sites are located (Moramarco and Singh, 2010). Using M to calculate $\Phi(M)$ and measuring $u_{\max}$, the mean velocity as the product of $\Phi(M)$ and $u_{\max}$ can be obtained. This result is also good for newly gauged river sites where a linear relationship between the mean and maximum velocities cannot be created due to a lack of velocity data.

Chiu and Said (1995) developed an efficient method for estimating the mean flow velocity. They estimated the location of the mean velocity and determined the discharge on a single vertical passing through the point of the maximum velocity in a channel cross section.

Moramarco and Singh (2010) developed a formula for $\Phi(M)$ as

$$\Phi(M) = \left(\frac{e^M}{e^M - 1} - \frac{1}{M}\right) = \frac{\frac{1}{n} R^{1/6} / \sqrt{g}}{\frac{1}{\kappa}[\ln(\frac{y_{\max}}{y_0}) + \frac{h}{y_{\max}} \ln(\frac{h}{D})]}$$

where κ is the Von Karman constant, $y_{\max}$ the distance of the maximum velocity location from the river bed, y_0 the distance of the zero velocity location from the river bed, D the water depth, and h the location of the maximum velocity below the water surface. If a topographical survey of the site is available and y_0 can be assessed, it would be enough to sample $u_{\max}$, and hence, h to obtain $\Phi(M)$, from which $\bar{u}$ can be obtained as the product between $\Phi(M)$ and $u_{\max}$.

The authors did not review a number of predecessor's publications before trying to publish their work. There are no important contributions (new knowledge or new method) in this manuscript. I regretfully have to reject this paper.

APPENDIX REFERENCES

Chiu, C. L. (1987). ''Entropy and probability concepts in hydraulics.'' *J. Hydraul. Eng.*, 113(5), 583–600.

Chiu, C. L. (1988). ''Entropy and 2-D velocity distribution in open channels.'' *J. Hydraul. Eng.*, 114(7), 738–756.

Chiu, C. L. (1989). ''Velocity distribution in open channel flow.'' *J. Hydraul. Eng.*, 115(5), 576–594.

Chiu, C. L. (1991). ‘‘Application of entropy concept in open-channel flow study.’’ *J. Hydraul. Eng.*, 117(5), 615–628.

Chiu, C. L., and Said, C. A. A. (1995). ‘‘Maximum and mean velocities and entropy in open-channel flow.’’ *J. Hydraul. Eng.*, 121(1), 26–35.

Moramarco, T., Saltalippi, C., and Singh, V. P. (2004). “Estimation of mean velocity in natural channel based on Chiu’s velocity distribution equation.” *J. Hydrol. Eng.*, 9(1), 42–50.

Moramarco, T., and Singh, V. P. (2008). “Streamflow measurements and discharge assessment during high flood events.” *Hydrology and Hydraulics*, V. P. Singh, ed., Vol. 899, Water Resources Publications, Littleton, Colo., Chap. 26, 940.

Moramarco, T., and Singh, V. P. (2010). “Formulation of the entropy parameter based on hydraulic and geometric characteristics of river cross sections.” *J. Hydrol. Eng.*, 15(10), 852–858.

Xia, R. (1997). ‘‘Relation between mean and maximum velocities in a natural river.’’ *J. Hydraul. Eng.*, 123(8), 720–723.