Discussion of "Direct Solutions for Uniform Flow Parameters of Wide Rectangular and Triangular Sections" by Ahmed A. Lamri, Said M. Easa, Mohamed T. Bouziane, Mohammad Bijankhan, and Yan-Cheng Han

Lotfi Zeghadnia

Professor, Laboratory of Modeling and Socio-Economic Analysis in Water Science (MASESE), Mohamed Cherif Messaadia Univ., Souk Ahras 41000, Algeria (corresponding author). ORCID: https://orcid.org/0000-0003-1409-3140. Email: lotfi.zeghadnia@univ-soukahras.dz

Imad Boukhari

Ph.D. Student, Laboratory of Soils and Hydraulic, Badji Mokhtar Annaba Univ., Annaba 23000, Algeria. Email: imadboukhari167@yahoo.com

Ali Rezaiguia

Assistant Professor, Dept. of Mathematics, College of Science, Hail Univ., Hail 81481, Saudi Arabia. Email: ali_rezaig@yahoo.fr

Fares Laouacheria

Senior Lecturer, Laboratory of Soils and Hydraulic, Badji Mokhtar Annaba Univ., Annaba 23000, Algeria. Email: fares.laouacheria@gmail.com

https://doi.org/10.1061/(ASCE)IR.1943-4774.0001583

The authors have proposed new explicit equations for the head loss and normal depth of wide rectangular and triangular open channel sections using the Colebrook white equation and Lagrange's inversion theorem.

The ASCE Task Force on friction factors in open channels (ASCE 1963) expressed its belief in the utility of using the Darcy-Weisbach formulation for resistance to flow in open channels for other than fully rough flow; however, these recommendations have almost been ignored, and the Manning-Strickler formulation continues to dominate, maybe because most pipes and channels flow under turbulent conditions (Boukhari et al. 2021; Zeghadnia 2007, 2014; Zeghadnia et al. 2014; Zeghadnia and Robert 2017).

Different mistakes were picked up through a deep analysis of the results; for instance, in the section "Modeling Friction Factor" of the original paper, the term for the hydraulic radius, R_h, was missed in Eqs. (8) and (10). They should be written as follows:

$$f=\left[c-2.03\log\left(\frac{\varepsilon R}{3.7088R_h}+\frac{1}{\sqrt{f}}\right)\right]^{-2}\tag{1}$$

$$f^{1/2}=c+\sum_{n=1}^{\infty}\frac{\left(\frac{-2.03}{\ln 10}\right)^n}{\Gamma(n+1)}\frac{d^{n-1}}{dc^{n-1}}\left\{\left[\frac{\varepsilon R}{3.7088R_h}+c\right]^n\right\}\tag{2}$$

Eq. (11) of the original paper can be simplified and rewritten as follows:

$$f^{-1/2}=c+2.03\log\left[-1+\frac{2.03}{b\ln 10}+0.5\left(\frac{2.03}{b\ln 10}\right)^2\ln\left(\frac{b}{e^2}\right)+\left(\frac{2.03}{b\ln 10}\right)^3\left(\frac{(\ln b)^2}{3}-\frac{3}{2}b+1\right)\right]\tag{3}$$

To estimate the accuracy of the proposed model, the authors have not taken enough values of ε/R_h and R to ensure the study of all possibilities; at first glance, it is easy to conclude that the computation steps were not small enough to judge the reliability of the proposed formulas. A deep investigation of the maximum error leads to the following:

To establish Fig. 1, random values from the ranges $10^{-6}\le\varepsilon/R_h\le 10^2$ and $4{,}000\le R\le 10^8$ were used.

Fig. 1 shows the maximum error that can be induced when using Eqs. (11) and (14) of the original paper, where the maximum error of Eq. (11) is 0.16%; however, for Eq. (14), the maximum error is 0.141%, which is different from what the authors indicated.

In the section "Modeling Normal Depths" (rectangular form) of the original paper, the term y_n^* was missed in Eq. (21). So, Eq. (21) is given as

$$h=\frac{8\sqrt{2}\varepsilon^*}{37.088\upsilon^*y^*}\tag{4}$$

More than one million—random—values were used to check the reliability of Eq. (22); the results plotted in Fig. 2 shows, without doubt, a huge deviation between Eq. (18) of the original paper and the proposed formula (Fig. 2), where the maximum relative errors recorded was 6.723%.

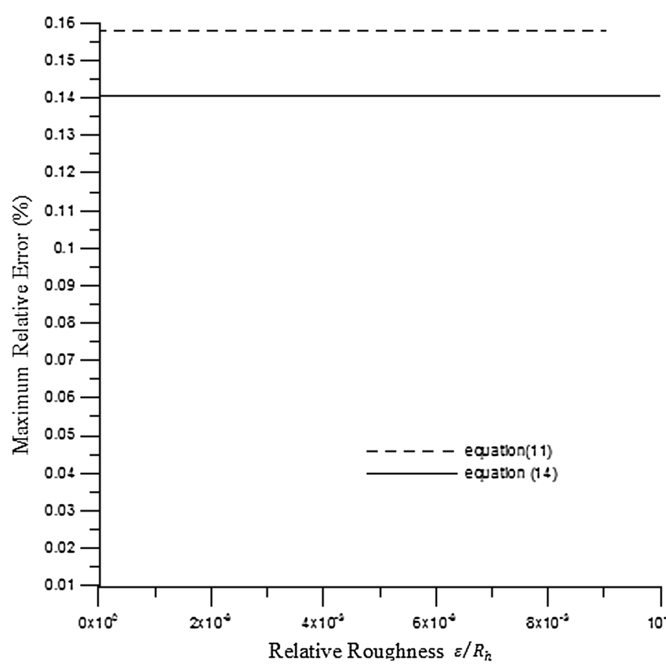

Fig. 1. The maximum deviation (in percent) for the entire range of: $10^{-6}\le\varepsilon/R_h\le 10^2$ and $4{,}000\le R\le 10^8$ of Eqs. (11) and (14).

J. Irrig. Drain Eng., 2023, 149(1): 07022021

The maximum error recorded for Eq. (6) was equal to or less than 0.1% as shown Fig. 5.

It can be seen that the proposed equations do not reflect the accuracy provided by the authors, especially Eq. (22) of the original paper. Corrections and improvements are proposed to enhance the results such as Eqs. (5) and (6).

References

ASCE. 1963. "Friction factors in open channels." *J. Hydraul. Div.* 89 (2): 97–143. https://doi.org/10.1061/JYCEAJ.0000865.

Boukhari, I., L. Zeghadnia, F. Laouacheria, A. S. Araibia, A. Guebail, J. L. Robert, and L. Djemili. 2021. "Design of collection system parameters using known reference pipe method (KRPM)." *Asian J. Water Environ. Pollut.* 18 (3): 21–30. https://doi.org/10.3233/AJW210025.

Zeghadnia, L. 2007. "Computation of the pressurized turbulent flow in circular pipe." Magister thesis, Dept. of Hydraulics, Badji Mokhtar Univ.

Zeghadnia, L. 2014. "Contribution Au Dimensionnement D'un Réseau d'Assainissement: En Tenant Compte de l'Aspect Stationnaire Et non Stationnaire De l'Ecoulement." Thèse De Doctorat En Science, Département d'hydraulique, Université Badji Mokhtar.

Zeghadnia, L., L. Djemili, and L. Houichi. 2014. "Analytic solution for the computation of flow velocity and water surface angle for drainage and sewer networks: Case of pipes arranged in series." *Int. J. of Hydrology Sci. & Tech.* 4 (1): 1–7. https://doi.org/10.1504/IJHST.2014.064413.

Zeghadnia, L., and J. L. Robert. 2017. "New approach for the computation of the water surface angle in partially filled pipe: Case of pipes arranged in parallel." *J. Pipline Syst. Eng. Pract.* 8 (4): 1–4. https://doi.org/10.1061/(ASCE)PS.1949-1204.0000272.