Calibration and Uncertainties of Pipe Roughness Height

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ABSTRACT

For a new type of pipes, the first thing from the hydraulics view of point is to calibrate the average roughness height k in hydraulic labs precisely. This paper did the systematical experiment to calibrate the values of k for the three types of pipes. The results illustrated that the value of k found by the Colebrook equation varied significantly with the change in Reynolds number Re. One of the reasons is that there are the uncertainties of the measurement data. The paper demonstrates how to calibrate k reasonably by the systematical analysis of the uncertainties for the measured parameters, such as pipe diameter, length, flow rate and headloss as well as width, height and head above crest level of weirs for flow rate measurement. At last, some important conclusions are obtained that: 1) the dimensionless standard uncertainties of headloss, flow rate and roughness coefficient all decrease monotonically with the increase of Re; 2) when $\mathrm{Re} > 4 \times 10^5$, with the increase of Re the roughness height varies slightly and its uncertainty reduces greatly; 3) and the tiny uncertainties of measured headloss, flow rate, pipe diameter and length can result in a quite great uncertainty of roughness height.

KEYWORDS

Calibration, roughness height, pipe, uncertainty