Doctoral Thesis

Mean roughness coefficient in open channels with different roughnesses of bed and side walls

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Mean Roughness Coefficient
in Open Channels with Different Roughnesses
of Bed and Side Walls

THESIS
PRESENTED TO
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to be as near as possible to it. On the other hand, we cannot be sure of the velocity measured near the wall as the measuring device causes some disturbances near the wall giving a bigger velocity head than would be expected. The fixing of the safe allowable nearest point to the wall depends on the dimensions of the velocity measuring device and must be determined by comparison with different devices. We have to notice here that the factor of time is a very important factor by using a Pitot-tube as we may have to wait at least 10 minutes in each point till the oscillations in the manometer connected to the Pitot-tube disappear, to get exact readings of the velocity head.

4. If we want to get a rough value of \( \tau_0 \) for any surface we have to measure the mean velocity on a line spaced 3 to 7 cm from the surface and parallel to it and then apply the method explained in the third attempt. For rough surfaces, if we don't know the approximate value of \( s \) we have to measure the mean velocity at least in two lines parallel to the surface.

5. This point of the shearing stress \( \tau_0 \) is very interesting and very important and requires further experimental investigations.

VIII. Summary

1. The principal aim of this work was to study the problem of the mean roughness coefficient in open channels, in the case that the bed and side walls have different roughnesses.

2. Three channels with different shapes and different roughness arrangements were studied. The dimensions of the three channels were: 100×35 cm, 50×35 cm and 60×60 cm.

3. It was found that both equations:

\[
\begin{align*}
    k_m &= \left[ \frac{P}{\sum \frac{P_i}{k_i}} \right]^{2/3} \\
    \lambda_m &= \frac{\sum P_i \lambda_i}{P}
\end{align*}
\]

act satisfactorily enough for both field and laboratory purposes.
4. An attempt was also made to determine the shearing stress between the wall and the fluid $\tau_0$ from the velocity distribution.

5. It was found that at 20 cm depth ($b = 60$ cm), $\tau_{0w}$ is bigger than $\tau_{0b}$. That shows that the definition of the hydraulic radius introduced by Chezy represents only a mean value of $\tau_0$. At bigger depths no definitive judgement could be given. It seems that the difference between $\tau_{0b}$ and $\tau_{0w}$ is small.

6. The problem of the shearing stress $\tau_0$ requires further experimental investigations which may lead to a new definition of the hydraulic radius, based on the separate values of $\tau_{0b}$ and $\tau_{0w}$.

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