

# Open-Channel Hydraulics

## H.W.#5 Steady Uniform Flow

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1. Show that if sands in the channel bed is uniform, Manning's  $n$  is constant along the channel, Darcy Weisbach's  $f$  changes a little and Chezy's  $C$  changes significantly.
2. Obtain the best hydraulic section of a rectangular cross section with a free board  $F$  at both sides.
3. In general, the wide open-channel can safely defined as a rectangular channel whose width is greater than 10-15 times the depth of flow. That is,

$$B/y = 10 - 15$$

where  $B$  is the width and  $y$  is the flow depth. In the wide open-channel, the dynamics due to the circulations in the direction transverse to the main flow direction can be ignored. Consider the (rectangular-shaped) open-channel at the hydraulic laboratory in Yonsei University. The width of the channel is about 1 m, and the flow depth of  $h = 0.25$  m is going to be maintained. The side wall is made of glass ( $n = 0.01$ ) and the channel bottom is covered by the concrete block ( $n = 0.03$  assumed) to supply extra roughness. Can this channel be considered as a wide rectangular open-channel?

4. Derive the governing equation for long wave theory which can be applied to many problems in open-channel flows by averaging the following continuity and momentum equations:

$$\nabla \cdot \vec{V} = 0$$

$$\frac{d\vec{V}}{dt} = -\frac{1}{\rho} \nabla p^*$$

where  $p^* = p + \gamma z$ . Explain why the wave celerity in the long wave theory is  $\sqrt{gh}$ .