

Tutorial 7

1. In a rectangular channel, the bed width is equal to 4 m and the discharge is $22.5 \text{ m}^3/\text{s}$. The channel has two long sections with slopes $S_1=0.0004$ and $S_2=0.009$ and Manning's coefficients $n_1=0.015$ and $n_2=0.012$, respectively. Identify the type of water surface profile along the channel.

2. A vertical sluice gate with an opening of 0.67 m produces a downstream jet when installed in a long concrete rectangular channel conveying a discharge of $20 \text{ m}^3/\text{s}$. The channel width is equal to 5 m, the Manning's coefficient of the channel is $n = 0.013$ and the channel slope is 0.00032. The contraction coefficient of the sluice gate is 0.6. Assuming that the flow downstream of the gate eventually returns to the uniform flow depth:
 - a. Verify that a hydraulic jump occurs downstream of the gate.
 - b. Assuming no energy losses through the gate, calculate the depth upstream of the gate.

3. A trapezoidal channel has a bottom width $b = 8 \text{ m}$ and a side slope ratio of 2:1 ($m=2$). The Manning's coefficient of the channel is $n = 0.025$ and it is laid on a slope of 0.001. If the channel ends in a free overfall, compute the water surface profile for a discharge of $30 \text{ m}^3/\text{s}$ using the direct step method.