Applied Hydraulics – Week 9 – Gradually Varied Flow (#2)

Reading Assignment: Chin, Ch. 3, section 3, pages 127-145.

Homework Problems: none

Hands-on Assignment

In this experiment you will create an M2 profile and an S2 profile in the laboratory flume, and then you will create a spreadsheet that uses the direct step method to calculate these two profiles

Procedure

1. Download the spreadsheet gvf2.xls from the class web page. This spreadsheet has an example M2 profile that you can use as a starting point for your calculations
2. Cover the bottom of the flume with a single layer of marbles over the entire flume length.
3. Set the flume bed slope to 0.0% (horizontal).
4. Set the flume discharge rate to some value between 1.2 and 2.5 L/s.
5. Set the flume flow rate to something between 0.5 and 1.5 L/s.
6. Using the point gauges, measure the water depth at enough locations to adequately represent the gradually varied flow profile. You will probably want more measurements near the downstream end of the channel. This profile should be an M2 profile. Calculate the Froude numbers at at least one location in the channel to confirm that the flow is subcritical.
7. Now increase the bed slope until the flow is supercritical. Calculate the Froude number as before to confirm this. You should now have an S2 profile set up in the flume.
8. Now repeat step 6. You will now want extra measurements upstream.

To Be Done Now or Later

1. Now use the downloaded spreadsheet to create calculated gradually varied flow M2 and S2 profiles. Be sure to check all calculations to confirm their correctness. For the S2 profile, calculate the Sf_{avg} as the linear average of the upstream and downstream friction slopes. You can check your calculations against those available on the web page for the S2 profile.
2. Now model an S3 profile by modifying the upstream depth in your spreadsheet so that it less than the uniform depth for the flow, slope, and roughness that you used in the previous step.