2.4 COMPUTATION BY DIRECT STEP METHOD AND STANDARD STEP METHOD

Gradually varied flow profiles shown above may be quickly solved by simple numerical techniques.

There are two basic numerical methods that can be used

i. Direct step – distance from depth

ii. Standard step method – depth from distance

1. The direct stepmethod – distance from depth

This method will calculate (by integrating the gradually varied flow equation) a distance for a given change in surface height.

$$\Delta x = \Delta y \left(\frac{1 - f^2}{s_0 - s_f} \right)$$

The steps in solution are

1.Determine the control depth as the starting point

2. Decide on the expected curve and depth change if possible

3. Choose a suitable depth step Δy

4. Calculate the term in brackets at the "mean" depth (y initial + Δy/2)

5. Calculate Δ x

6. Repeat 4 and 5 until the appropriate distance / depth changed reached.

2.The standard step method – depth from distance

This method will calculate (by integrating the gradually varied flow equation) a depth at a given distance up or downstream.

$$\Delta E = \Delta x (s_0 - s_f)$$

The steps in solution are similar to the direct step method shown above but for each x there is the following iterative step

1. Assume a value of depth y (the control depth or the last solution depth)

2. Calculate the specific energy EsG

3. Calculate S f

4. Calculate Δ Es

5. Calculate E s(x+ Δx) s = E + Δ E

6. Repeat until ΔE s (x+ Δx) = E sG

The Standard step method – alternative form

This method will again calculate a depth at a given distance up or downstream but this time

$$\Delta \boldsymbol{H} = -\Delta \boldsymbol{x}\left(-\boldsymbol{s_f}\right)$$

where H = y+z+$\frac{\alpha v^2}{2g}$

The strategy is the same as the first standard step method, with the same necessity to iterate for each step.