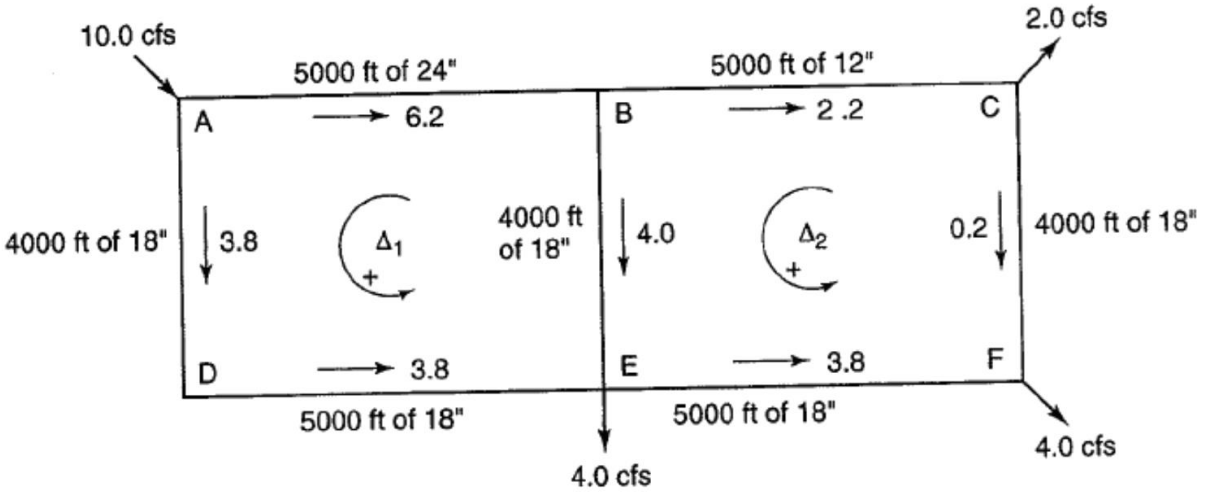
HW3 – Due 10/01/2020 (October 1 by 2:00 PM)

1. Determine the flow rate in each pipe for the simple network in the figure below. Assume Darcy-Weisbach friction factor is $f = 0.02$ for all the pipes. Use Hardy-Cross method. Perform at least 3 iterations to finalize the flow rate. Start with the flow rates given in the figure. (30 points).
2. Once flow rates are determined please use the final flow rates to determine the headlosses in each pipe. (10 points).
3. Also determine the total heads at each node if the total head at A is 100 ft. (10 points).



Review

Network Simulation

Step by step procedure in Hardy Cross

Following are the steps in Hardy-Cross algorithm to solve a network.

1. Determines the value of K using headloss equation
2. Guess pipe flow such as conservation mass satisfies at all nodes. Assume $\Delta Q_{LP} = 0$ for all loops
3. Compute sum of headlosses around a loop applying $Q + \Delta Q_{LP}$ with proper sign
4. Compute denominator of the equation for the same loop
5. Solve equation for ΔQ_{LP}
6. Repeat steps 3 to 5 for each loop in the network
7. Repeat steps 3 to 6 iteratively until all the ΔQ_{LP} are small enough

Loop Correction

$$\Delta Q_{LP} = -\frac{\sum_{l \in lloop} K_l {Q_l}^n}{\sum_{l \in lloop} n K_l [Q_l]^{n-1}}$$

$$\Delta Q_{LP} = -\frac{\sum_{l \in lloop} K_l {Q_l}^n}{\sum_{l \in lloop} n \left|\frac{h_{L,l}}{Q_l}\right|} = -\frac{\sum_{l \in lloop} h_{L,l}}{\sum_{l \in lloop} n \left|\frac{h_{L,l}}{Q_l}\right|}$$

Where the denominator is an absolute