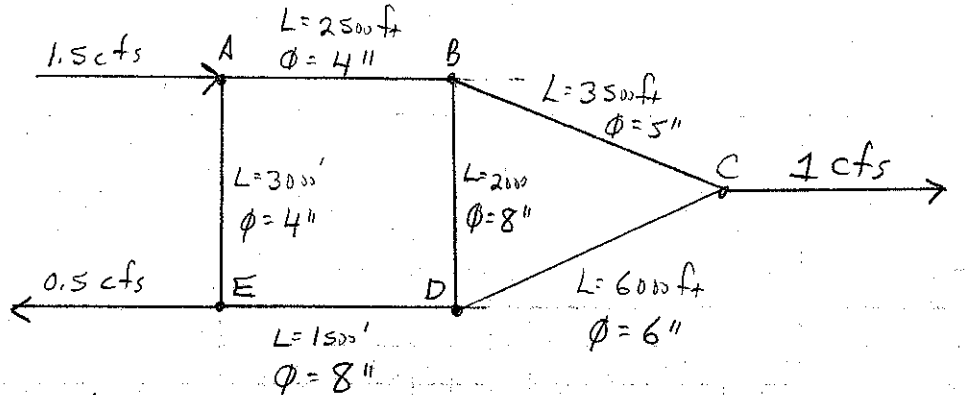
HARDY-CROSS EXAMPLE (one-iteration)

Calculate Q in each pipe of the network shown.



1. $C_W = +$

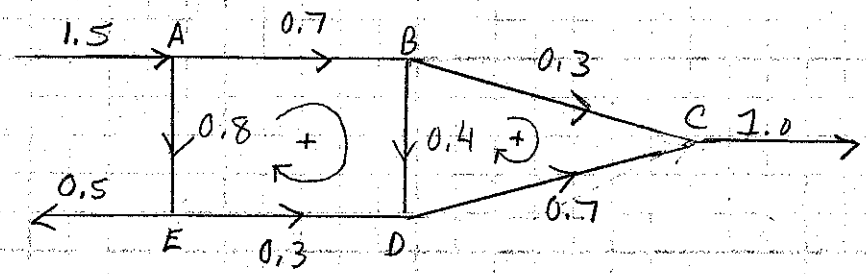
2/3 2 loops
Loop ABDE
Loop BCD

4 $K' = \frac{(0.0252)\, f\, L}{D^5}$ f assumed to be 0.02 for all pipes

Pipe AB $K' = \frac{(0.0252)(0.02)(2500)}{(0.3333)^5} = 306.2$

Pipe		
BC	K' =	140.5
DC	K' =	96.8
BD	K' =	7.7
ED	K' =	5.7
AE	K' =	367.4

5.



6. $$\delta = \frac{-\sum k' Q_a^2}{2 \sum |k' Q_a|}$$

δ ABDE

$$\frac{-[(306.2)(0.7)^2 + (7.7)(0.4)^2 - (5.7)(0.3)^2 - (367.4)(0.8)^2]}{2[(306.2)(0.7) + (7.7)(0.4) + (5.7)(0.3) + (367.4)(0.8)]}$$

$\delta_{ABDE} = +0.08$

δ BCD

$$\frac{-[(140.5)(1.3)^2 - (96.8)(0.7)^2 - (7.7)(0.4)^2]}{2[(140.5)(0.3) + (96.8)(0.7) + (7.7)(0.4)]}$$

$\delta = +0.16$

7. Corrected flows

pipe	AB	$0.7 + (0.08) = 0.78$
	BC	$0.3 + (0.16) = 0.46$
	DC	$0.7 - (0.16) = 0.54$
	BD	$0.4 + (0.08) - (0.16) = 0.32$
	ED	$0.3 - (0.08) = 0.22$
	AE	$0.8 - (0.08) = 0.72$