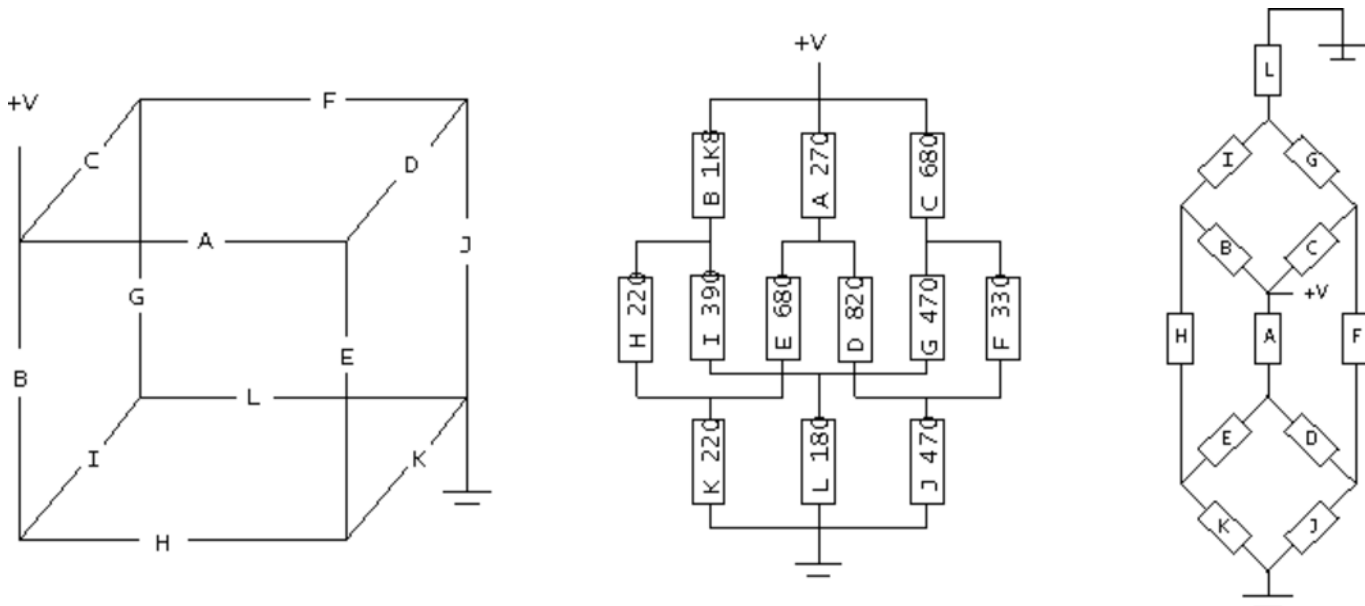


Solving the resistor cube.

I assembled a bunch of resistors, as follows:



DELTA - WYE TRANSFORMS - ACTUAL STEPS FOLLOWED TO SOLVE THE CUBE.

a) WYE E / A / D TO DELTA EA / AD / DE

$$\begin{aligned} EA &= (A \times D + D \times E + E \times A) / D = ((270 \times 820) + (820 \times 680) + (680 \times 270)) / 820 = 1173.9 \\ AD &= (A \times D + D \times E + E \times A) / E = ((270 \times 820) + (820 \times 680) + (680 \times 270)) / 680 = 1415.6 \\ DE &= (A \times D + D \times E + E \times A) / A = ((270 \times 820) + (820 \times 680) + (680 \times 270)) / 270 = 3565.2 \end{aligned}$$

b) DELTA H / B / EA TO WYE HB / BEA / EAH

$$\begin{aligned} HB &= H \times B / (H + B + EA) = 396,000 / 3193.9 = 24 \\ EAH &= EA \times H / (H + B + EA) = 258,258 / 3193.9 = 80.86 \\ BEA &= B \times EA / (H + B + EA) = 2,113,020 / 3193.9 = 661.6 \end{aligned}$$

c) DELTA C / F / AD TO WYE ADC / CF / FAD

$$\begin{aligned} CF &= C \times F / (C + F + AD) = 224,400 / 2,425.6 = 92.5 \\ FAD &= F \times AD / (C + F + AD) = 467,148 / 2425.6 = 192.6 \\ ADC &= AD \times C / (C + F + AD) = 962,608 / 2425.6 = 396.85 \end{aligned}$$

d) DELTA J / K / DE TO WYE JK / KDE / DEJ

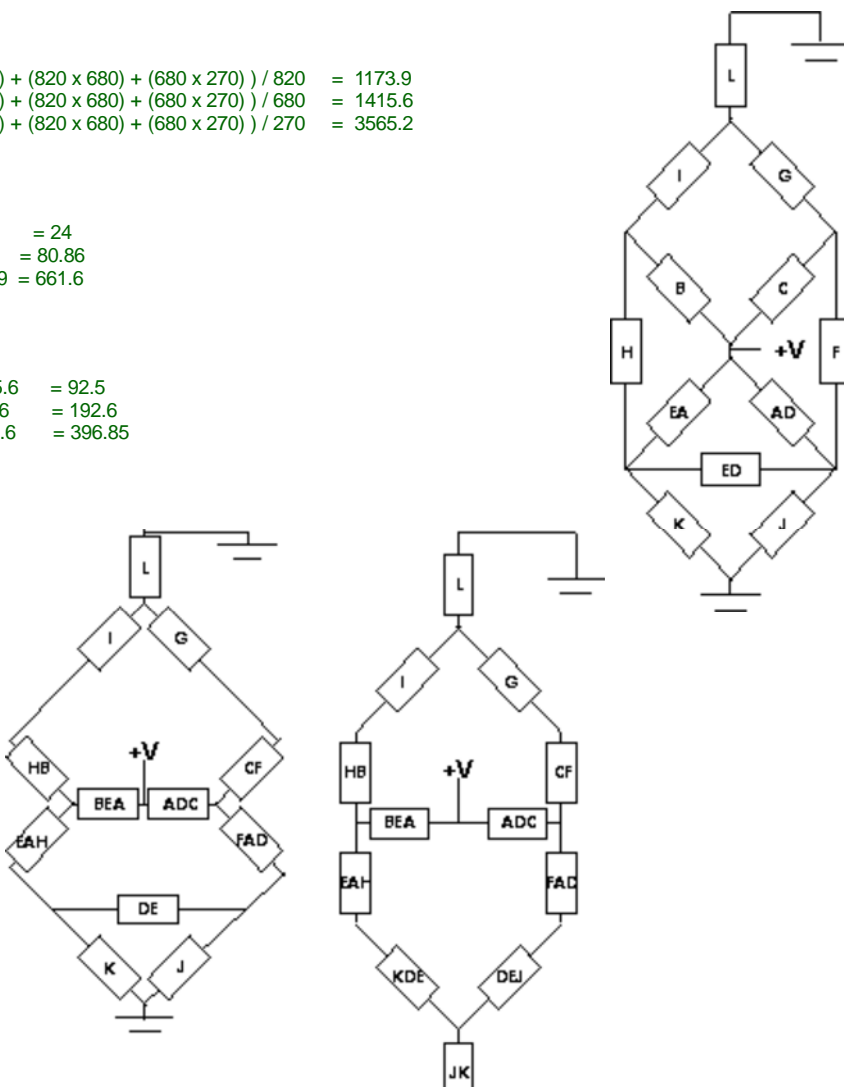
$$\begin{aligned} JK &= J \times K / (J + K + DE) = 103,400 / 4,255.2 = 24.3 \\ KDE &= K \times DE / (J + K + DE) = 7884,344 / 4,255.2 = 184.33 \\ DEJ &= DE \times J / (J + K + DE) = 1,675,644 / 4255.2 = 393.8 \end{aligned}$$

e) SOLVING THE SERIES

$$\begin{aligned} M &= EAH + KDE = 80.86 + 184.33 = 265.19 \\ N &= FAD + DEJ = 192.6 + 393.8 = 586.4 \\ O &= IGIL + HB = 390 + 124 = 514 \\ P &= LGIG + CF = 470 + 92.5 = 562.5 \end{aligned}$$

f) WYE O / M / BEA TO DELTA MO / OBEA / BEAM

$$\begin{aligned} MO &= (O \times BEA + BEA \times M + M \times O) / BEA = 651,831.5 / 661.6 = 985.2 \\ OBEA &= (O \times BEA + BEA \times M + M \times O) / M = 651,831.5 / 265.2 = 2,457.9 \end{aligned}$$

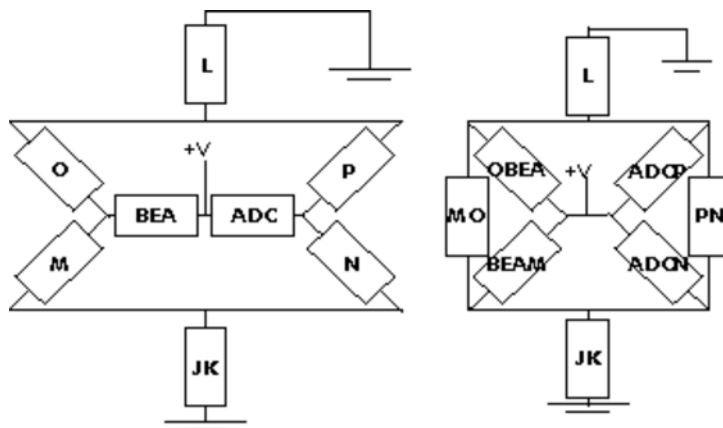


$$BEAM = (O \times BEA + BEA \times M + M \times O) / O = 651,831.5 / 514 = 1268.15$$



g) WYE ADC / P / N TO DELTA ADCP / PN / ADCN

$$\begin{aligned} ADCP &= (P \times N + ADC \times N + ADC \times P) / N = 785,791 / 586.4 = 1340 \\ ADCN &= (P \times N + ADC \times N + ADC \times P) / P = 785,791 / 562.5 = 1397 \\ PN &= (P \times N + ADC \times N + ADC \times P) / ADC = 785,791 / 396.85 = 1980 \end{aligned}$$



h) SOLVING THE PARALLELS

$$\begin{aligned} 1/Q &= 1/OBEA + 1/ADCP, \text{ then, } Q = 867.21 \\ 1/R &= 1/BEAM + 1/ADCN, \text{ then, } R = 664.73 \\ 1/S &= 1/MO + 1/PN, \text{ then, } S = 645.71 \end{aligned}$$

i) DELTA H / B / EA TO WYE HB / BEA / EAH

$$\begin{aligned} SR &= S \times R / (S + R + Q) = 429,222.8 / 2177.65 = 197.1 \\ SQ &= S \times R / (S + R + Q) = 559,966.2 / 2177.65 = 257.14 \\ QR &= Q \times R / (S + R + Q) = 576,460.5 / 2177.65 = 264.7 \end{aligned}$$

j) SOLVING THE SERIES

$$\begin{aligned} T &= SQ + L = 257.1 + 180 = 437.1 \\ U &= SR + JK = 197.1 + 24.3 = 221.4 \end{aligned}$$

k) SOLVING THE LAST PARALLEL

$$1/V = 1/T + 1/U, \text{ then, } V = 146.96$$

l) LAST SERIES

$$\begin{aligned} R_{tot} &= QR + V = 264.7 + 146.96 \\ &= 411.7 \text{ ohms} \end{aligned}$$

