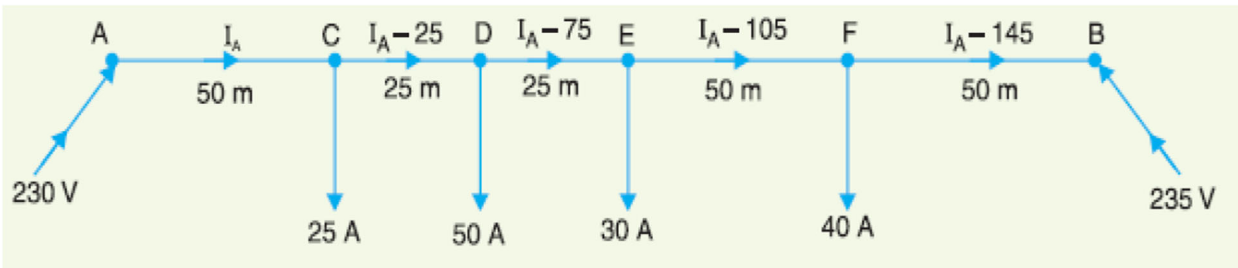
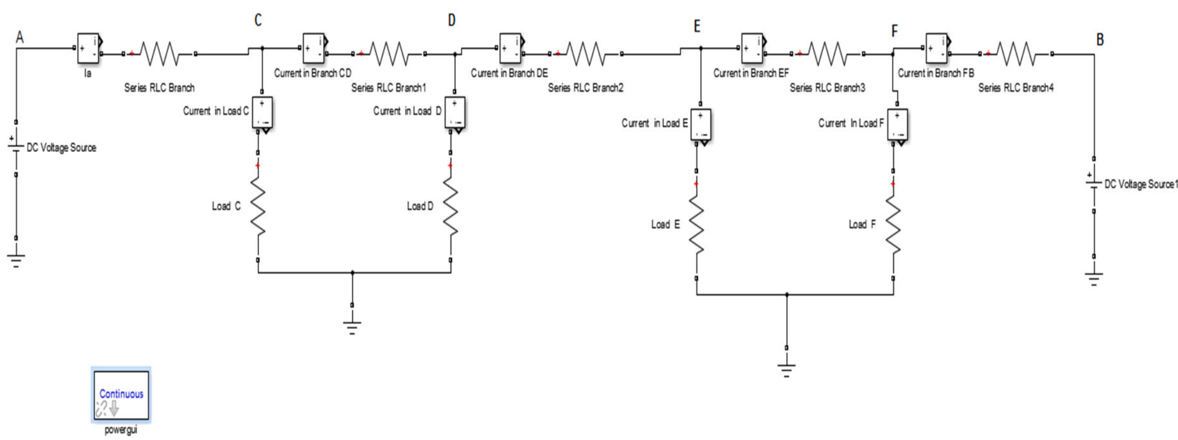
| Name | Umar Hayyat |
|---|---|
| Roll No | 2019-EE-360 |

# Complex Engineering Problem(CEP)
# Session 2019 Fall 2021
# Power Distribution System

## Circuit:




## Simulation:




## Results:

```
MEASUREMENTS:

  1:  'I Ia                     '  =        33.33 A
  2:  'I Current in Branch FB'  =      -111.67 A
  3:  'I Current in Branch EF'  =       -71.67 A
  4:  'I Current in Branch DE'  =       -41.67 A
  5:  'I Current in Branch CD'  =         8.33 A
  6:  'I Current  in Load E  '  =        30.00 A
  7:  'I Current  in Load C  '  =        25.00 A
  8:  'I Current  in Load  D '  =        50.00 A
  9:  'I Current  In Load F  '  =        40.00 A
```

**Calculation:**

Resistance of 2 wires of 1k m length = 2 * 0·3 = 0·6 Ω

Resistance of branch AC $= 0.6\left(\frac{50}{1000}\right) = 0.03\ \Omega$

Resistance of branch CD = $0.6\ \left(\frac{25}{1000}\right) = 0.015\ \Omega$

Resistance of branch DE = $0.6\left(\frac{25}{1000}\right) = 0.015\ \Omega$

Resistance of branch EF = $0.6\left(\frac{50}{1000}\right) = 0.03\ \Omega$

Resistance of branch FB = $0.6\left(\frac{50}{1000}\right) = 0.03\ \Omega$

**Voltage drops using Exact Method**

$$V_B = V_A - (I_A * R_{AC} + (I_A - 25) * R_{CD} + (I_A - 75) * R_{DE} + (I_A - 105) * R_{EF} + (I_A - 145) * R_{FB})$$

Put values of $V_A$ , $V_B$ , $R_{AC}$ , $R_{CD}$ , $R_{DE}$ , $R_{EF}$ and $R_{FB}$ in Equ

$$235 = 230 - (0.03\ I_A + 0.015\ (I_A - 25) + 0.015\ (I_A - 75) + 0.03\ (I_A - 105) + 0.03\ (I_A - 145))$$

$235 = 230 - (0.12\ I_A - 9)$

$I_A = \frac{239-235}{0.12} = 33.34$

$I_A = 33.34$ A

$I_{AC} = I_A = 33.34$ A

$I_{CD} = I_A - 25 = 33.34 - 25 = 8.34$ A

$I_{DE} = I_A - 75 = 33{\cdot}34 - 75 = -41.66$ A

$I_{EF} = I_A - 105 = 33{\cdot}34 - 105 = -71.66$ A

$I_{FB} = I_A - 145 = 33{\cdot}34 - 145 = -111{\cdot}66$ A

Voltage at point C = $V_C = V_A - I_A R_{AC} = 230 - (33.34 * 0.03) = 228.998$

Voltage at point D = $V_D = V_A - (I_{AC}\ R_{AC} + I_{CD}\ R_{CD})$

$V_D = 230 - (33.34 * 0.03 + 8.34 * 0.015)$

$V_D = 230 - 1.125$

$V_D = 228.875$

Voltage at point E = $V_E = V_B - (I_{BF}\ R_{FB} + I_{FE}\ R_{EF})$

$V_E = 235 - (111.66 * 0.03 + 71.66 * 0.03)$

$V_E = 229.5$

Voltage at point F = $V_F = V_B - I_{BF} R_{FB}$

$V_F = 235 - (111.66 * 0.03)$

$V_F = 231.65$

Voltage drop of C = $V_A - V_C$ = 230 – 228.998 = 1.002
Voltage drop of D = $V_A - V_D$ = 230 – 228.875 = 1.125
Voltage drop of E = $V_B - V_E$ = 235 – 229.5 = 5.5
Voltage drop of F = $V_B - V_F$ = 235 – 231.65 = 3.35

**Voltage drop by using approximate method**

Voltage drop VD = IR
$VD_C = 25*0.03$
$VD_C = 0.75V$
$VD_D = 50*(0.03 + 0.015)$
$VD_D = 2.25V$
$VD_E = 30*(0.03 + 0.03)$
$VD_E = 1.8V$
$VD_F = 40*0.03$
$VD_F = 1.2V$
Total voltage drop b/w point A and B is:
$\sum VD = VD_C + VD_D + VD_E + VD_F$
$\sum VD = 0.75 + 2.25 + 1.8 + 1.2$
$\sum VD = 3.15V$

**<u>Comparision:</u>**

| Currents | Simulation result | Calculated result |
|---|---|---|
| $I_{AC}$ | 33.33A | 33.34A |
| $I_{CD}$ | 8.33A | 8.34A |
| $I_{DE}$ | -41.67A | -41.66A |
| $I_{EF}$ | -71.67A | -71.66A |
| $I_{FB}$ | -111.67A | -111.66A |

The result of simulation are same as I calculated. The values that I calculate by using exact method are same as simulated. So, simulation use exact method.