

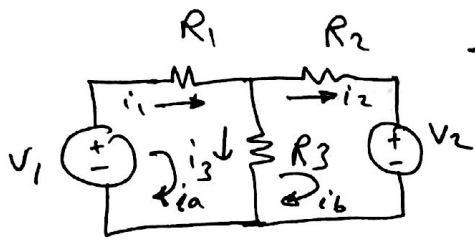
1

4.5, 4.6, 4.7

4.8 cancelled

# Meshcurrent Method

ex)



no. of loops (closed) = 2  
 ∴ two equations KVL

1) assume loop current in loop 1,  $i_a$   
 & " " " " " " " " " "  $i_b$

∴ 1) loop 1:  $\sum V = \sum IR$

فرض اتجاه دوران التيار  $i_a$  و كل ما اقابل (-) بطرف كبت  
 فقط بال (+) و بلكه

$\sum IR =$  كبت  $i_a$  مضروب في جميع المقاومات التي يمر عليها التيار  
 لم ندرجه من كل branch مشترك مضروب في ليت تباخر اسهل في الترتيب  
 ارجو ان يكون واضحاً

$\sum V_i = \sum I_a R$

$+V_1 = I_a(R_1 + R_3)$  ←  $(I_b R_3)$  →  $I$   
 قطع لانه ما عكس اتجاه  $i_a$

Loop 2:  $-V_2 = i_b(R_2 + R_3) - i_a R_3$  → II  
 عكس اتجاه  $i_b$  ← عكس اتجاه  $i_b$

Ex

Find Power associated with each voltage source  
 - find  $V_{across}$



- loop 1
- 2
- 3

$+40 = i_a(2+8) - i_b 8$

$40 = 10i_a - 8i_b + 0i_c$

$0 = i_b(6+6+8) - 8i_a - 6i_c \Rightarrow 0 = -8i_a + 20i_b - 6i_c$

$-20 = i_c(4+6) - 6i_b \Rightarrow -20 = 0i_a - 6i_b + 10i_c$

$i_c, i_b, i_a$  → ...

$$\Delta = \begin{vmatrix} 10 & -8 & 0 \\ -8 & 20 & -6 \\ 0 & -6 & 10 \end{vmatrix} = 10[200-36] + 8[0+120] + 0 = 1000$$

$$\Delta_1 = \begin{vmatrix} 40 & -8 & 0 \\ 0 & 20 & -6 \\ -20 & -6 & 10 \end{vmatrix} = 40[200-36] + 8[0+120] + 0 = 5600$$

$$\Delta_2 = \begin{vmatrix} 10 & 40 & 0 \\ -8 & 0 & -6 \\ 0 & -20 & 10 \end{vmatrix} = 10[0-120] - 40[-80] + 0 = 2000$$

$$\Delta_3 = \begin{vmatrix} 10 & -8 & 40 \\ -8 & 20 & 0 \\ 0 & -6 & -20 \end{vmatrix} = 10[-400] + 8[160] + 40[48] = -800$$

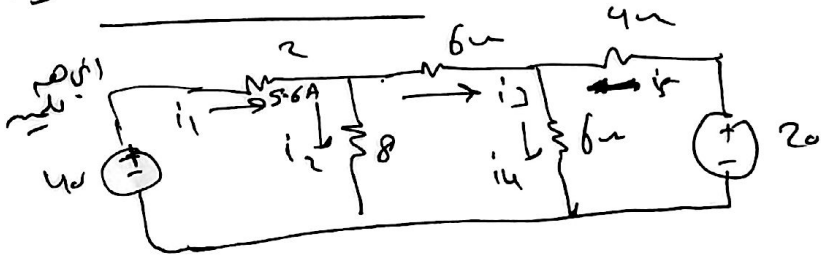
$$\therefore i_a = \frac{\Delta_1}{\Delta} = \frac{5600}{1000} = 5.6 \text{ A}$$

$$i_b = \frac{\Delta_2}{\Delta} = \frac{2000}{1000} = 2 \text{ A}$$

$$i_c = \frac{-800}{1000} = -0.8 \text{ A}$$

(پ ب سے متعلقہ تہا بہت کم ہے)

From figure  $\rightarrow i_1 = i_a$   
 $\rightarrow i_2 = i_a - i_b$   
 $= 5.6 - 2 = 3.6 \text{ A}$   
 اس تہا بہت کم ہے



$$\rightarrow i_3 = i_2 = 2 \text{ A}$$

اس تہا بہت کم ہے

$$\rightarrow i_c = 0.8 \text{ A}$$

تہا بہت کم ہے  
 $+0.8 \text{ A}$

$$\rightarrow i_4 = i_b - i_c = 2 + 0.8 = 2.8 \text{ A}$$

اس تہا بہت کم ہے

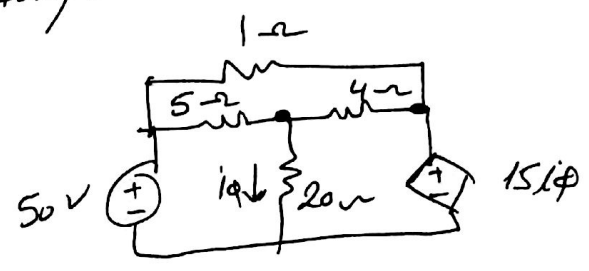
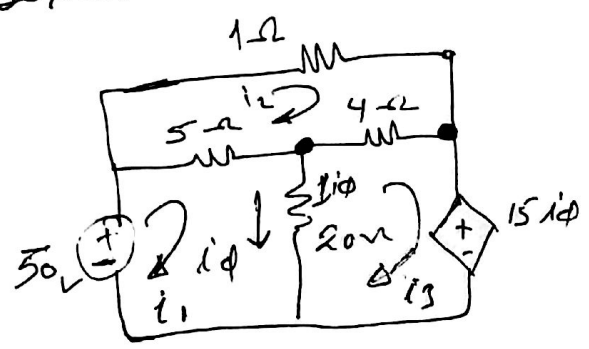
$$P_{20\Omega} = i_5 \times 20 = 0.8 \times 20 = 16 \text{ W} \quad \text{delivered}$$

$$P_{4\Omega} = i_a \times 40 = 5.6 \times 40 = 224 \text{ W} \quad \text{delivered}$$

Source Node  $\rightarrow$  Power  $\rightarrow$  delivered  
 $-224 \text{ W}$   $-16 \text{ W}$

$$\rightarrow V_{8\Omega} = i_2 \times 8 = 3.6 \times 8 = 28.8 \text{ V}$$

Case 2:- Dependent source  
 Use Mesh-Current method to determine Power dissipated in 4- $\Omega$  Resistor



Loop ①  $50 = i_1(5+20) - 5i_2 - 20i_3 \rightarrow \text{I}$

Loop ②  $0 = -5i_1 + (1+4+5)i_2 - 4i_3 \rightarrow \text{II}$

Loop ③  $-15i_\phi = -20i_1 - 4i_2 + (4+20)i_3 \rightarrow \text{III}$

Constraint  $i_\phi = i_1 - i_3$

or eq(3)  $\Rightarrow -15(i_1 - i_3) = -20i_1 - 4i_2 + 24i_3$   
 $-15i_1 + 15i_3 = -20i_1 - 4i_2 + 24i_3$   
 $0 = -5i_1 + 4i_2 + 9i_3 \rightarrow \text{III}'$

Solve I, II, III'  $\Rightarrow i_2 = 26A$   
 $i_3 = 28A$

We need  $P_{4\Omega} = I_{4\Omega}^2 \times 4 = (i_3 - i_2)^2 \times 4$   
 $= (28 - 26)^2 \times 4 = 16W$

4

Case 3: Mesh current method (special case) { Branch of current source }

①  $100 - v = i_a(3+6) - i_b \times 3 \rightarrow \text{I}$

②  $0 = i_b(10+2+3) - i_a \times 3 - i_c \times 2 \rightarrow \text{II}$

③  $-50 + v = i_c(2+4) - 2i_b \rightarrow \text{III}$

④  $i_c - i_a = 5 \rightarrow \text{V}$

or  $i_c = 5 + i_a$

Sub in II  $\therefore 15i_b - 3i_a - 2[5 + i_a] = 0$

$15i_b - 5i_a = 10$

$3i_b - i_a = 2$

or  $i_a = 3i_b - 2 \rightarrow \text{IV}$

Sub in I  
Solve I, III

$S_0 = 9i_a - 5i_b + 6i_c$

or  $S_0 = 9[3i_b - 2] - 5i_b + 6[5 + i_a]$

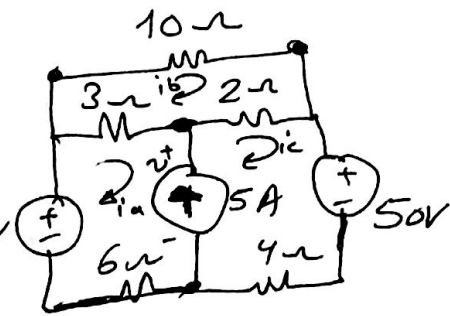
$S_0 = 27i_b - 18 - 5i_b + 30 + 6[3i_b - 2]$

$S_0 = 22i_b + 12 + 18i_b - 12 = 40i_b$

$\therefore i_b = \frac{5}{4} = 1.25 \text{ A}$

$i_a = 3i_b - 2 = 3 \times 1.25 - 2 = 1.75 \text{ A}$

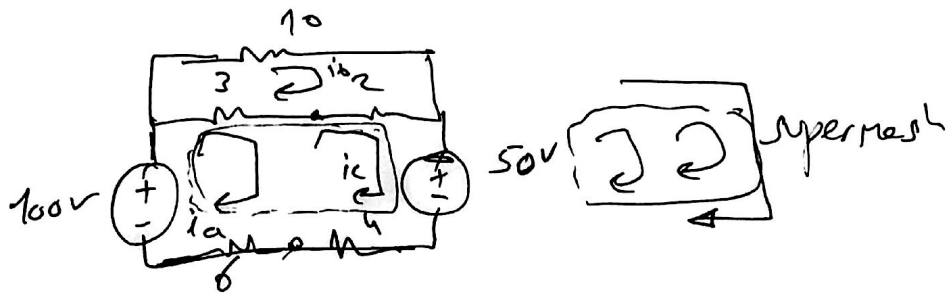
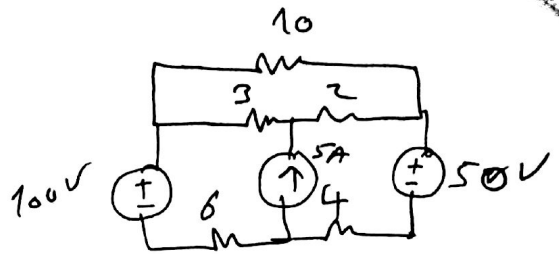
$i_c = 5 + i_a = 6.75 \text{ A}$



sources  $\rightarrow$  be  $v$  gap  
+  
-  
-2

Case 4: SuperMesh

اینکه متقاطع مع یکدیگر نیستند  
و تلف پیرایش ده



① loop 1  $\Rightarrow 0 = i_b(10+2+3) - 3i_a - 2i_c \rightarrow \textcircled{1}$

loop 2  $\Rightarrow -50+100 = i_a[3+6] + i_c[2+4] - 3i_b - 2i_b$

SuperMesh

$50 = 9i_a + 6i_c - 5i_b$  تقریباً 4

note  $\underline{5 = i_c - i_b}$  حل پیرایش 4

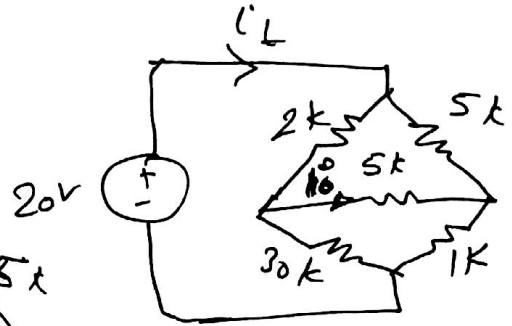
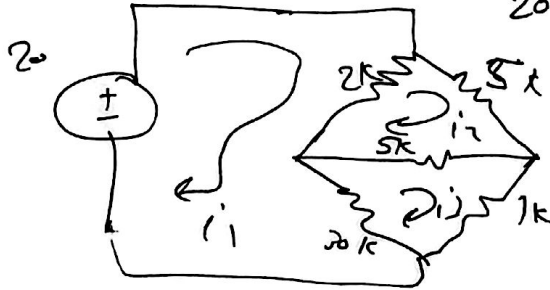
Mesh / Nodal / تپا  
؟

- ① use which have fewer equations to solve.
- ② if there are Supernodes used nodal
- ③ " " superMesh use mesh.



5.5mA  
2mA  
Find  $i_t$ ,  $i_o$   
EXTRA Problem (2)  
Using Mesh

sol



①  
 $20 = i_1(2k + 30k)$   
 $= 2k i_2$   
 $= 30k i_3$

②  $0 = i_2(2k + 5k + 5k) - 2k i_1 - 5k i_3$

③  $0 = i_3(5k + 1k + 30k) - 30k i_1 - 5k i_2$

①  $\Delta = \begin{vmatrix} 32 & -2 & -30 \\ -2 & 12 & -5 \\ -30 & -5 & 36 \end{vmatrix} = \frac{20}{1000} = 32i_1 - 2i_2 - 30i_3 = \frac{1}{50}$

②  $0 = -2i_1 + 12i_2 - 5i_3$

③  $0 = -30i_1 - 5i_2 + 36i_3$

$\Delta = \begin{vmatrix} 32 & -2 & -30 \\ -2 & 12 & -5 \\ -30 & -5 & 36 \end{vmatrix} = 32[12 \times 36 - 25] + 2[-2 \times 36 - 5 \times 30] - 30[10 + 12 \times 30]$   
 $= 1480$

$\Delta_1 = \begin{vmatrix} \frac{1}{50} & -2 & -30 \\ 0 & 12 & -5 \\ 0 & -5 & 36 \end{vmatrix} = \frac{1}{50} [12 \times 36 - 25] + 2[0] - 30[0]$   
 $= 8.14$

$\Delta_2 = \begin{vmatrix} 32 & \frac{1}{50} & -30 \\ -2 & 0 & -5 \\ -30 & 0 & 36 \end{vmatrix} = 32[0] - \frac{1}{50} [-2 \times 36 - 5 \times 30] - 30[0]$   
 $= +4.44$

$\Delta_3 = \begin{vmatrix} 32 & -2 & \frac{1}{50} \\ -2 & 12 & 0 \\ -30 & -5 & 0 \end{vmatrix} = 32[0] + 2[0] + \frac{1}{50} [10 + 12 \times 30]$   
 $= 7.4$   
 $i_1 = \frac{\Delta_1}{\Delta} = \frac{8.14}{1480} = \frac{0.0055}{5.5 \text{ mA}} \parallel i_2$

71

$$i_1 = \frac{\Delta_1}{\Delta} = \frac{8.14}{1480} = 0.0055 \text{ A} = \underline{\underline{5.5 \text{ mA}}}$$

$$i_2 = \frac{\Delta_2}{\Delta} = \frac{4.44}{1480} = 0.003 \text{ A} = 3 \text{ mA}$$

$$i_3 = \frac{\Delta_3}{\Delta} = \frac{7.4}{1480} = 0.005 \text{ A} = 5 \text{ mA}$$

$$\left\{ \begin{array}{l} i_0 = i_3 - i_2 = (5 - 3) \text{ mA} = 2 \text{ mA} \\ i_t = i_1 = 5.5 \text{ mA} \end{array} \right.$$

کارینتانی لولہ کے ساتھ  
دور

عینہ

Good Luck