

Tutorial 3

1. Give physical interpretation of product $A_{rG}GA_{rG}^Tx$ where A_{rG} is reduced incidence matrix of a graph of network, G is conductance matrix and x is node potential vector.
2. Write cutset of graph given in fig.1.

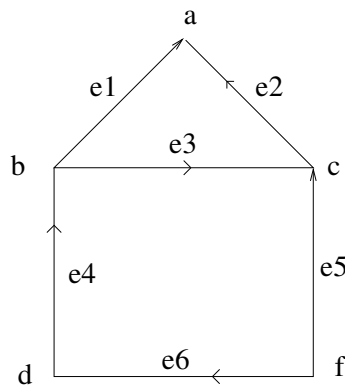


Figure 1: Graph for finding cutset.

3. Derive dual of the circuit given in fig.2 and show that voltage vector of one circuit and current vector of its dual circuit belong to same vector space or vice versa.
4. Show that if a crossing edge set separates two connected components of a graph, it will be minimal crossing edge set.
5. Minty's theorem says that every edge in a directed graph must belong to either a directed cutset or directed circuit set. Show this in graph given in Fig.1.
6. Show that by opening an edge in a tree gives two connected trees.
7. Find the Newton-Raphson equivalent network for the nonlinear network given in Fig.3.

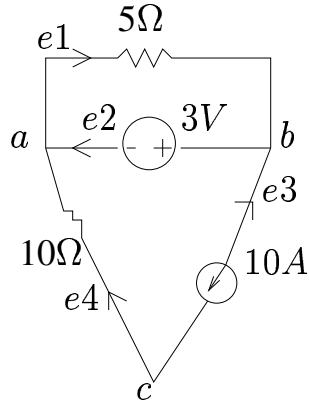


Figure 2: Network for finding dual.

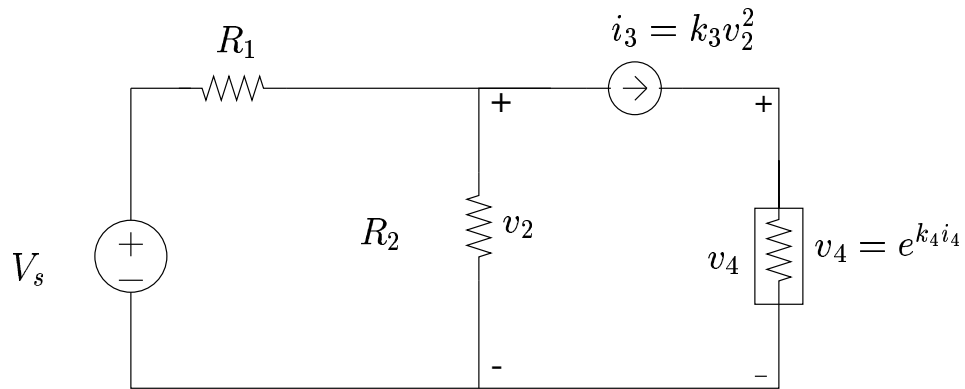


Figure 3: Network for linearizing.

8. Solve the circuit of Fig.4 using NR up to two iterations. The equation of diode is $I = e^{0.5V} - 1$. Take initial values across both the diodes as 0V. Let V' and I' are the voltage and current for a device in linearized circuit. Solution is converged when value of I' for a device in linearized circuit is close to 1% of the value of corresponding I obtained from diode equation at V' . Check if the solution is converged for the given circuit after 2 iterations.
9. Convert dynamic circuit given in Fig.5 to static circuit using Euler's method.

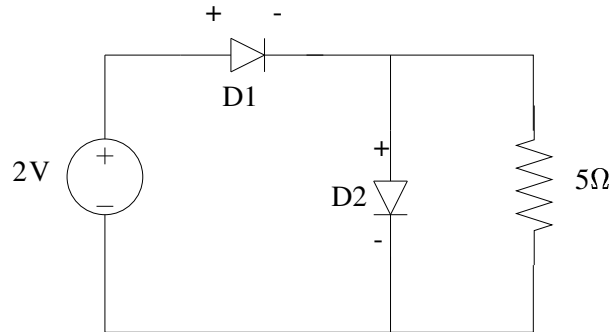


Figure 4: Network for solving using NR .

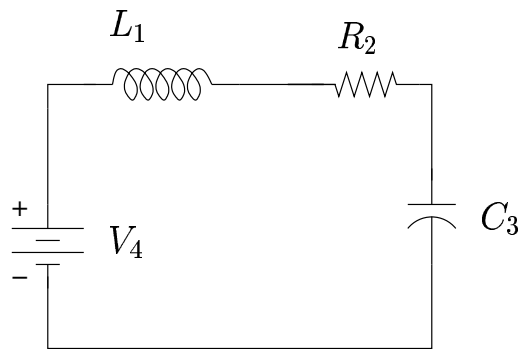


Figure 5: Dynamic network for converting into static network.