

There are two circuits containing resistors, inductors, capacitors and ideal independent sources given below. The sources are sinusoidal, and the circuits are assumed to be in the steady state. Use phasor analysis to study the networks. Assign node and branch numbers and directions to the circuit that you will use for the rest of this assignment.

- 1 Write the reduced node incidence matrix  $\mathbf{A}$ . Choose a reference node. Get the node admittance matrix  $\mathbf{Y}_n$  by inspection.
- 2 Write the mesh matrix  $\mathbf{M}$ . Get the mesh impedance matrix  $\mathbf{Z}_m$  by inspection.
- 3 Select a tree for the graph. Write the fundamental cutset matrix  $\mathbf{Q}$ . Get the cutset admittance matrix  $\mathbf{Y}_q$  by inspection.
- 4 For the same tree selected above, write the fundamental loop matrix  $\mathbf{B}$ . Get the loop impedance matrix  $\mathbf{Z}_l$  by inspection.
- 5 Now replace the independent current source  $I$  in the first circuit by a dependent current source given by  $I = V'$ . Now write all the node KCL equations manually, and get the modified  $\mathbf{Y}_n$ . Write all the cutset KCL equations manually, and get the modified  $\mathbf{Y}_q$ .
- 6 Now replace the independent voltage source  $V$  in the second circuit by a dependent voltage source given by  $V = I'$ . Now write all the mesh KVL equations manually, and get the modified  $\mathbf{Z}_m$ . Write all the loop KVL equations manually, and get the modified  $\mathbf{Z}_l$ .

