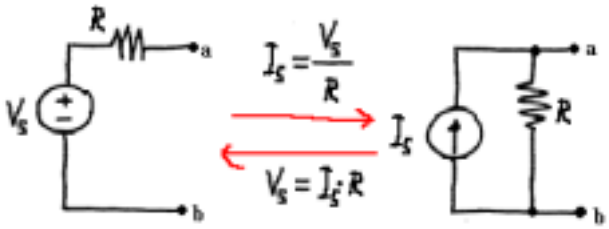
EECE 202 NETWORK ANALYSIS I **Dr. Charles J. Kim**

Note 18: Summary of Chapter 4

1. Nodal analysis is the application of KCL at the non-reference nodes, in terms of the node voltages. Steps of the analysis:
   a. Select an essential node as the reference node
   b. Assign node voltages to the remaining essential nodes
   c. At each of the nodes, express the branch currents in terms of node voltages using Ohm's Law. See the KCL in disguise?
   d. Solve the resulting simultaneous equations to obtain the unknown node voltages.

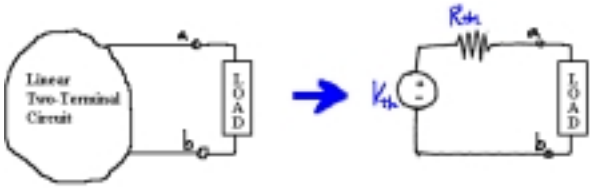
2. Mesh analysis is the application of KVL around meshes, in terms of mesh currents. Steps of the analysis:
   a. Assign mesh currents to the meshes
   b. Using Ohm's Law, express the voltages in a mesh in terms of the mesh current. See KVL in disguise?
   c. Solve the resulting simultaneous equation to get the mesh current

3. Source transformation is a procedure for transforming a voltage source in series with a resistor to a current source in parallel with a resistor, or vice versa.



4. The Thevenin theorem allows to isolate a portion of a network while the remaining portion of the network is replaced by an equivalent network.

   a. The Thevenin equivalent circuit consists of a voltage source V_{th} in series with a resistor R_{th}.



   b. V_{th} can be drawn by finding the open-circuit voltage at the terminals.

c. R_{th} can be drawn by 3 different methods:

(c.1) *Input Resistance Method*: Equivalent resistance after deactivation of the sources is R_{th}. Valid only when the linear circuit has no dependent sources.

(c.2) *Short Current Method*: R_{th} is the ratio of the Thevenin voltage V_{th} and the short circuit current (I_{sc}) through the shorted terminals. There should not be source deactivation.

$$R_{th} = \frac{V_{th}}{I_{sc}}$$

(c.3) *Test Voltage Method*: R_{th} is the ration of the test voltage V_T and the current flowing to the circuit (after deactivation of independent source) from the test voltage source (I_T), i.e.,

$$R_{th} = \frac{V_T}{I_T}$$

5. For a given Thevenin circuit, maximum power transfer occurs when $R_L=R_{th}$, i.e., when the load resistance is equal to the Thevenin resistance.

6. The superposition principle states that for a circuit having multiple independent sources, the voltage across (or current through) an element is equal to the algebraic sum of all the individual voltages (or currents) due to each independent source acting one at a time.