

- We now introduce a new concept, a *dependent source*. It can be a current source or a voltage source, which one it is is easily understood from its notation in the schematic. In the circuit it acts as a source, but its value depends on the value of some variable elsewhere in the circuit - either a current or a voltage. The dependence is given in the form of a function, and we confine ourselves to linear functions. A dependent source is to be treated just as any other source when you first write out KCL or KVL equations in a circuit. But after writing the equation, we use its dependency expression to replace the term containing the source with a term that contains the controlling variable. Write the KVL equations for the three meshes 1, 2, 3 in the circuit shown in Fig.1, when $V_2 = -3I + V/90^\circ$.
- For the circuit in Fig.2, write the two KCL equations at nodes 1, 2 when $I_2 = -5V + I/30^\circ$.

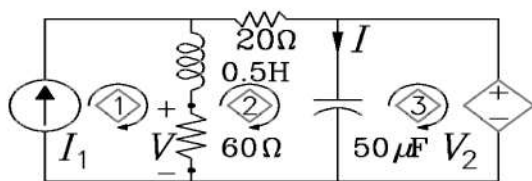


Fig.1

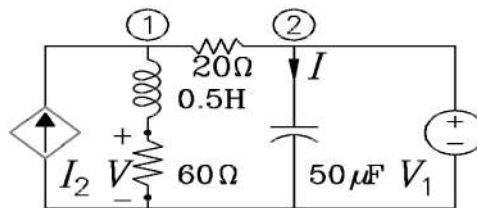


Fig.2

- For the circuit in Fig.3, write the KVL equations for the three meshes 1, 2, 3. $M = 0.1H$.
- Examine the two network graphs shown in Fig.4, and follow the given vertex and edge labeling given.
 - Write the full node incidence matrix \mathbf{A}_a .
 - Sketch two different trees for each graph. The branches in the graph other than the tree branches are also called nontree branches or *link* branches.
 - For each graph given, choose a particular tree. Number the tree branches as 1, 2, $n_t - 1$. Remove one tree branch at a time (erase it). When this is done, each time, the tree falls apart into two separate parts. List, for each such case, the set of all branches in the original graph that connect any node in one part to a node in the other. This set will always contain exactly one tree branch (the one you removed): the rest are link branches. Together, they are called the *cut set* associated with the removed tree branch.
 - What is the number of cut sets associated with a given graph? Is there an formula for the number of link branches too, in terms of the number of vertices n_t and total number of branches b ?

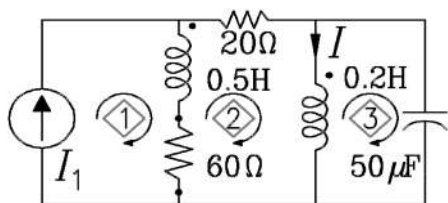


Fig.3

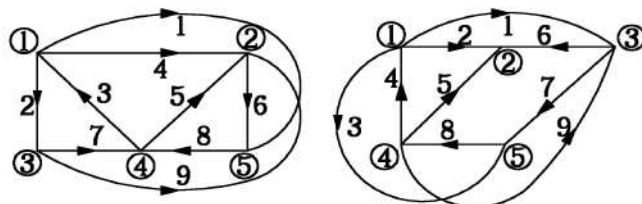


Fig.4