Basic Electrical Circuits
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Lecture - 35

Now, that we are familiar with circuit elements and their behavior relationships, we will go on to look at systematic waves of involving large circuits. We have already analyzed circuits along the way while working out examples and so on, we have found solutions to some circuits and that constitute circuits analysis. But, the methods we are used were ad hoc and easy to use for simple circuits, but cannot be scaled up efficiently for large circuits.

So, for large circuits we need to have systematic waves of analysis and that is what we are going to study. But, before we go to the systematic waves of analyses, first we will find out what is it that we have to solve.

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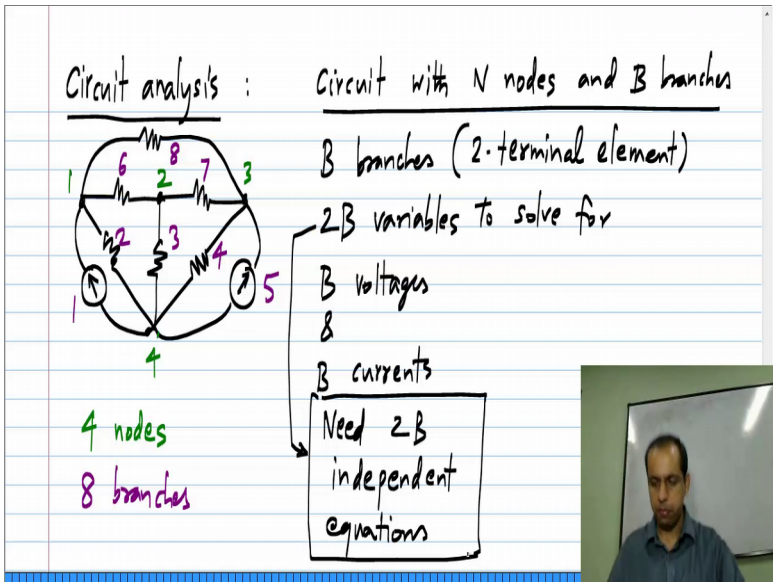

Now, let us consider some general circuit, for now the function of the circuit is not of significant to us, there is some circuit like this. Now, this circuit has 4 nodes and many branches 1, 2, 3, 4, 5, 6, 7, 8, so there are 8 branches. So, in general when we have a circuit, we will have a certain number of nodes and a certain number of branches. So, in general we could have a circuit with N nodes and B branches. Now, what is that we want to solve? Basically, we want to solve for the current and voltage in every branch, in every element.

For, now we will consider two terminal elements, but exactly the same thing can be generalized to larger number of terminals. So, if we have two terminal elements. So, B branches and each branch can be considered a two terminal element, then we will have 2 B variables to solve for basically B voltages and B currents. So, now, we have to solve for 2 B variables, B voltages and B currents; that means, that we need 2 B independent equations.

So, if you have a circuit with B branches and each branch constitutes a two terminal element, then we need 2 B independent equations, we have to somehow generate them from circuit loss as well as the element behavior and then, if we solve for these equations we will find the solution to our circuit. So, this is what is meant by completely solving for a circuit.

Now, in the problems given in an assignments or in books, you may not be asked to solve for everything, that is if you have 5 resistors and 2 voltage sources, may be you will not be ask for to solve like 7 voltages and currents. But, in general that is what is meant by solving for the circuit. So, in particular problems may be some current is of more interest than the others, but the general methods we look for, we will try to solve everything in the circuit.

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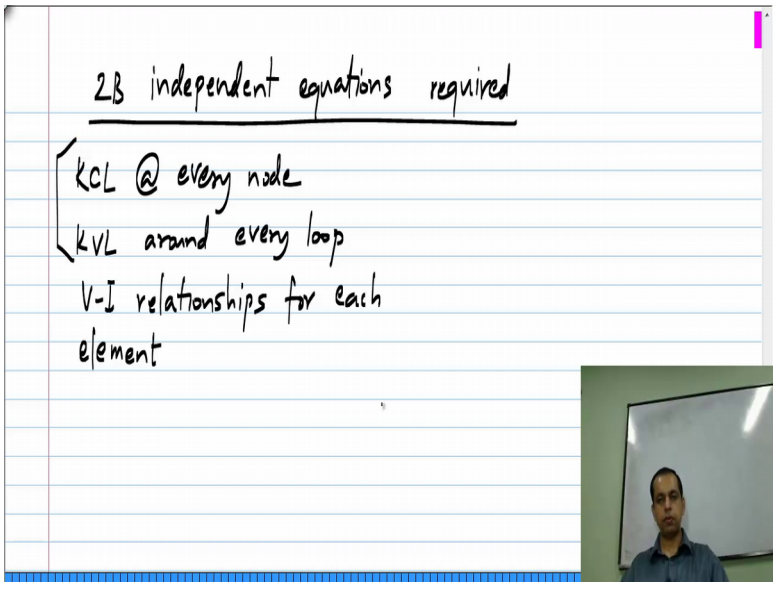

Now, how do we get this? What are the principles we use to solve our circuit? We have Kirchhoff's current law at every node and Kirchhoff's voltage law around every loop and finally, these are of course, general properties of all circuits. Finally, we have the specific

properties of elements in our circuits and we have V-I relationships for each element. So, these are what we have to use to solve over circuit.