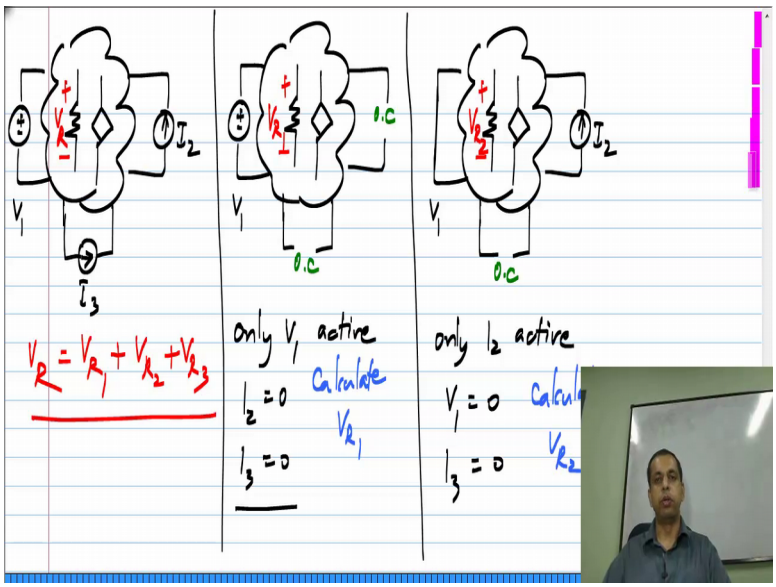
Basic Electrical Circuits
Dr Nagendra Krishnapura
Department of Electrical Engineering
Indian Institute of Technology Madras

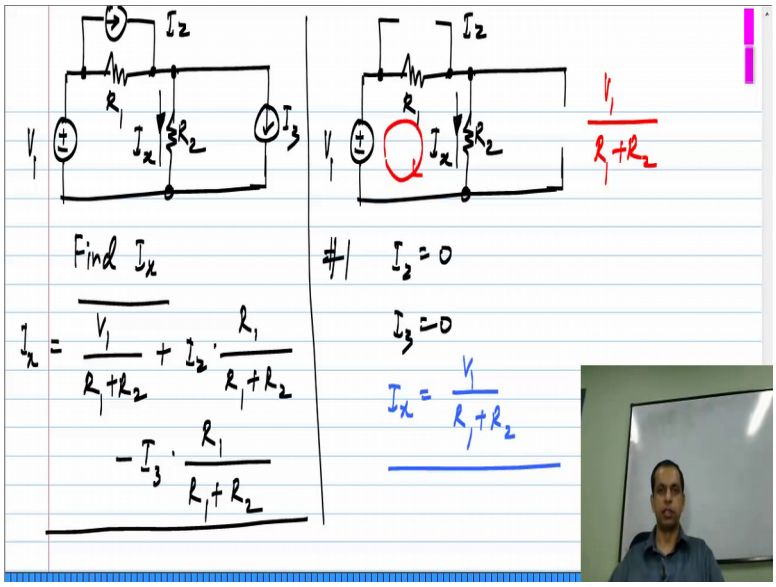
Lecture - 40

We now show an example illustrating this super position.

(Refer Slide Time: 00:01)



(Refer Slide Time: 00:09)

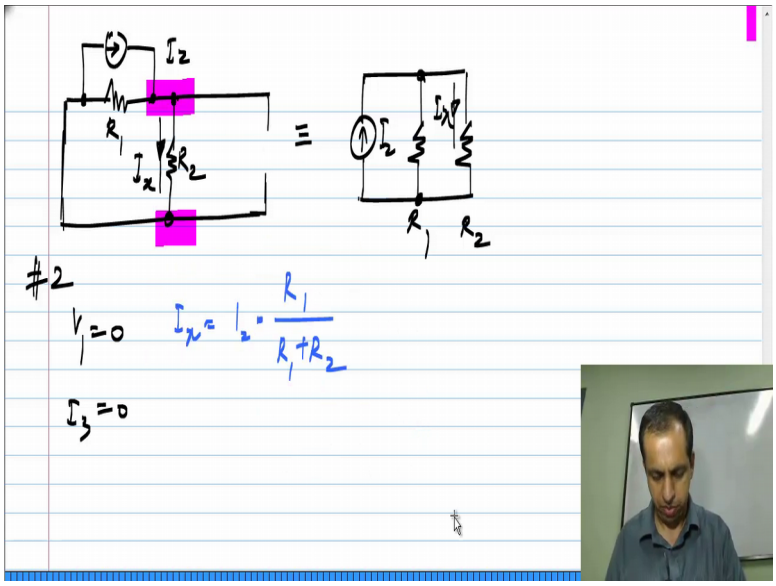


So, let me take a circuit similar to what I had in the illustration. So, I have three current sources V 1 I 2 and let me just reverse the direction of this I 3 and let me call these R 1 and R 2. And let me say that what I am interested in is the current I x, so the problem is

to find I x in this circuit. So, what do I do following my method of super position? I take the exact same circuit, but first, in the first step I have only V 1 and I set I 2 to 0 and I 3 to 0. So, what does that mean? These two have become open circuits.

Now, the resulting circuit is a single loop circuit with V 1 applied across the series combination of R 1 and R 2. So, we can find the current in this loop very easily and you know that, that is V 1 divided by R 1 plus R 2 and if you look at the definition of I x, it is in the same direction as this current. So, I x from the first step will be V 1 by R 1 plus R 2.

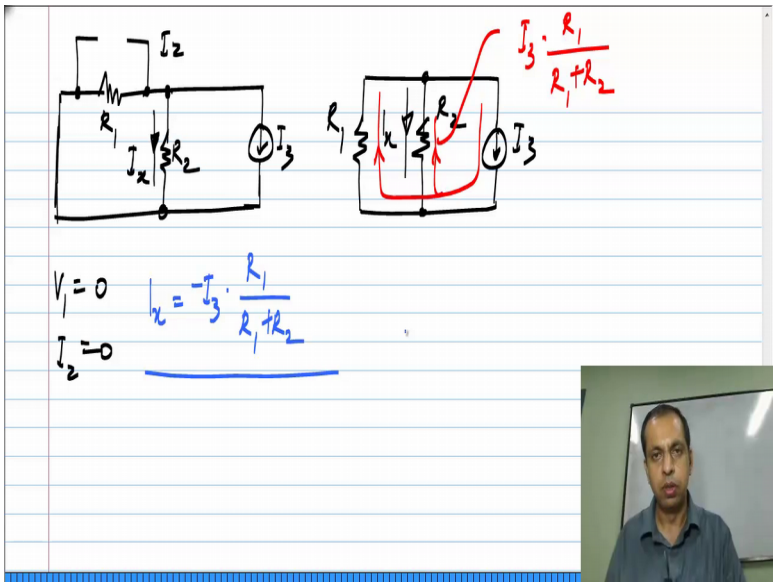
(Refer Slide Time: 02:23)



Now, in the second step I set V 1 to 0 and I 3 to 0, which means that this becomes an open circuit and v 1 being 0 makes it a short circuit. Now, again this is drawn in a strange way, if I redraw it all I have is I 2 applied across R 1 and R 2 and I x is the current, this is what I meant by being careful, you please mark the nodes, I x is the current flowing downwards from here to there and that is what I have taken it to be here.

If you are getting confused with this in a larger circuit, you number all the nodes and keep track of connections between nodes. So, in this case what do we have, I x will be equal to I 2 times R 1 by R 1 plus R 2 from the current divider expression. So, in the second step this is what I have got.

(Refer Slide Time: 03:50)



Finally, the last step I set V 1 to 0 and I 2 to 0, so; that means that, this becomes a short circuit and I 2 being 0 makes it an open circuit and I have only I 3 and just for convenience I will redraw that once more. So, again it is I 3 applied across R 1 and R 2 and I x is defined in this direction. So, now, the current flowing through R 2, see this total current I 3 gets divided into two parts and flows into R 2 and R 1. The part that flows into R 2, this part is given by I 3 times R 1 by R 1 plus R 2 from the current divider expression.

You also see that this current that we calculated is an opposite direction to I x. So, I x is minus I 3 times R 1 by R 1 plus R 2. So, we have the results from the three steps, which we sum together to find the current I x, the total current I x and that is given by I x is V 1 divided by R 1 plus R 2 plus I 2 times R 1 by R 1 plus R 2 minus I 3 times R 1 by R 1 plus R 2. So, this is how you use super position to analyze circuits with multiple independent sources.

So, these are the circuit analysis techniques that we can use, but these are kind of adhoc, by looking at the circuit we make parallel and series combinations and from there, find the solution. So, the super position is a way of extending this analysis with single independent source to multiple independent sources. In the next couple of units, we will be looking at systematic methods of analysis for arbitrarily large circuits.