Basic Electrical Circuits
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Lecture - 86

Now, we will calculate h parameters for some examples circuit as usual we will take the same circuit as we did for the other two parameters, so that you can compare the results.

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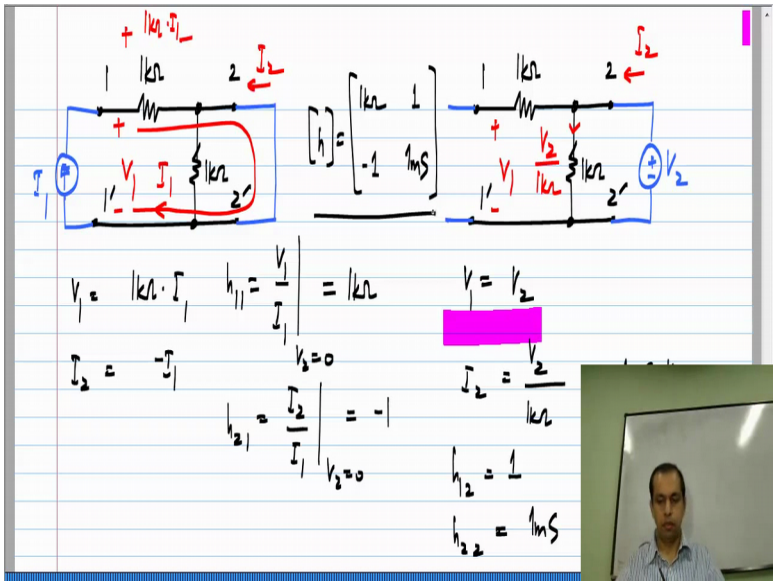

This is the circuit for, which I would like to compute the h parameters port 1, port 2 and any two cases one invites port 2 is short circuited and you apply a current to port 1 and the second case, where port 1 is open circuited and you apply a voltage 2 port 2. Now, this is kind of getting repetitive, so those of you her very familiar with circuit analysis I suggest that you simply calculate the h parameters of this and forward to the end of the lecture and see if they match whatever I derive, if you are not very comfortable with circuit analysis and these parameter definitions and so on, so you can follow the lecture.

Again, I would still encourage you to do the calculations first, but we can follow the lecture completely. So, now, what I need to evaluate in this are I 2 in this direction and V 1 the same for both circuits I 2 and V 1. So, let us take the first circuit over here, this short circuit across port 2 is shorting out this 1 kilo ohm resistor. So, no current flows through this 1 kilo ohm and all of I 1 flows in that direction, flows that way.

So, this V 1 is nothing but, the voltage drop across this 1 kilo ohm resistor, which is 1 kilo ohm times I 1, so after that we have a short circuit. So, V 1 is 1 kilo ohm times I 1 and I 2 you can see that it is simply the opposite of this current I 1. So, I 2 is minus I 1 and from these two, what do we get h 1 1 is V 1 by I 1 with V 2 set to 0, which comes out to be 1 kilo ohms and h 2 1, which is I 2 by I 1 with V 2 set to 0 and this comes out to be minus 1.

So, you can see that h 1 1 has dimensions of resistance and h 2 1 is dimension less it is the current gain from port 1 to port 2. Now, coming to the second case over here, so here this 1 kilo ohm is in series with an open circuit, so no current flows through that all of this I 2 is simply the current through this 1 kilo ohm. And V 2 appears across the 1 kilo ohm resistor, so the current here is nothing but, V 2 divided by 1 kilo ohm and V 1 equals V 2, because no current is flowing through this 1 kilo ohm resistor.

So, we have V 1 to be equal to V 2 and I 2 to be equal to V 2 divided by 1 kilo ohm or 1 Millisiemens times V 2. From these two you clearly see that h 1 2 is 1 that comes from this equation and h 2 2 is 1 Millisiemens that comes from this equation. So, the h parameter matrix for this circuit as expected has highbred quantities, the resistance here is 1 kilo ohms and this is just one, this is minus 1 and there we have 1 Millisiemens, so that is the h parameter matrix of this circuit.

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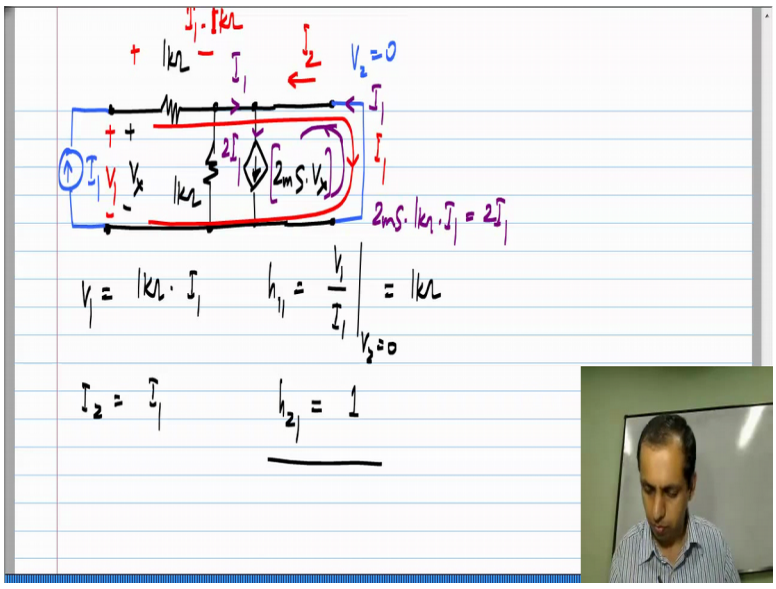

So, again taking a more complicated example with I control source, we can also calculate the h parameters 1 kilo ohm, 1 kilo ohm and 2 Millisiemens times V x, where V x over here. And for the first case we said V 2 equal to 0 or short circuit port 2 apply a current I 1 and we want to find this voltage V 1 and that current I 2. So, how do we do this, first of all is I 1 simply flows through this 1 kilo ohm. So, across this we have I 1 times 1 kilo ohm.

Now, you see that there is a short circuit from here to there, so the voltage V 1 is simply the voltage across this 1 kilo ohm resistor. So, V 1 is 1 kilo ohm times I 1 or h 1 1, which is V 1 by I 1 with port 2 shorted is 1 kilo ohm. Now, because of the short circuit, no current flows through this 1 kilo ohm resistor whatever I 1 was there, so this I 1 flows into this 1 kilo ohm and through the short circuit.

So, I 1 flows that way, but that is not the only current that flows there, because we have the control source as well and how much of the control source x 2 Millisiemens times V x and V x is nothing but, V 1 and V 1 is 1 kilo ohm times I 1. So, this current over here, which flows in this direction also through the short circuit, because there is a short circuit across the control current source and all of it is current will flow through the short circuit will be remember it is an opposite direction to I 1 and that is 2 Millisiemens times V x, which is V 1, which is 1 kilo ohm times I 1, which is 2 I 1.

So, we have I 1 flowing directly this way and 2 I 1 flowing them. So, the actual current that is flowing in this short circuit, the total current I just showed this I 1 over there it is not the current flowing here that actual current flowing there is the sum of I 1, which is coming from there and 2 I 1 which is going there which is equal to I 1 flowing that way. So, I 2 will be exactly equal to I 1 in this particular case if this control source as different proportionality constant it would be different. So, we have I 2 equals I 1, which tells you that h 2 1 is nothing but, 1. So, that is the value h 2 1 the current gain from port 1 to port 2.

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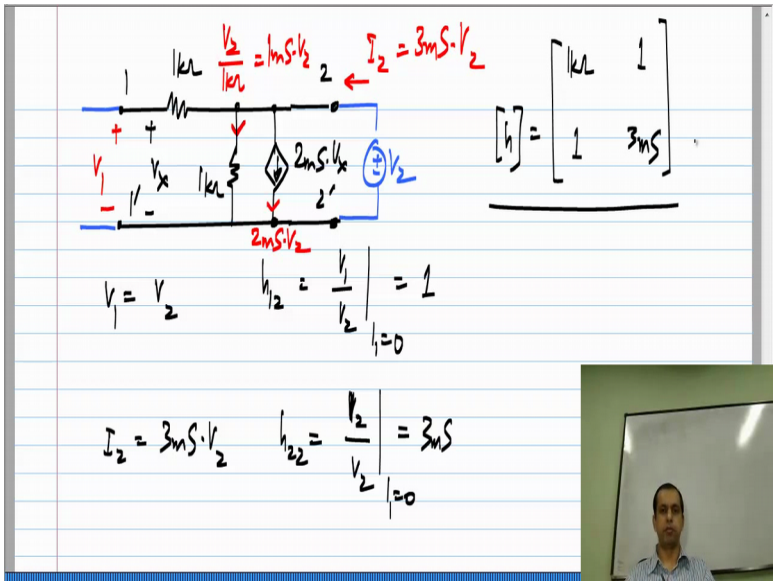

Now, for the second case we have port 1 open circuited and a voltage V 2 apply to port 2, where V x appears there. So, again we have to calculate this current I 2 and this voltage V 1 and you see that V x is the same as V 1 and also no current flows to the 1 kilo ohm resistor, so the voltage V 2 here is exactly the same as V 1. So, we have V 1 equals V 2, which tells you that h 1 2, which is V 1 by V 2 with port 1 open circuited a simply 1.

So, now, we have to calculate I 2 first of all this V 2 appears across the 1 kilo ohm resistor. So, we have V 2 by 1 kilo ohm or 1 Millisiemens times V 2 flowing through the resistor and we also have 2 Millisiemens times V x, which is 2 Millisiemens times V 1, V 1 is the same as V x which is also the same as V 2. So, the current here as 2 Millisiemens times V 2. So, the total current I 2 is 3 Millisiemens times V 2, so I 2 is 3 Millisiemens times V 2, so h 2 2 is I 2 by V 2 with port 1 open circuited, which is 3 Millisiemens.

The h parameter matrix of this is h 1 1, which is 1 kilo ohm h 1 2 which is 1 h 2 1, which is also 1 and h 2 2, which is 3 Millisiemens, so that is the h parameter matrix. So, again you should be able to calculate this easily calculating of the two port parameters is simply regular circuit analysis.