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

Lecture - 92
Relationship between Different Two port Parameters

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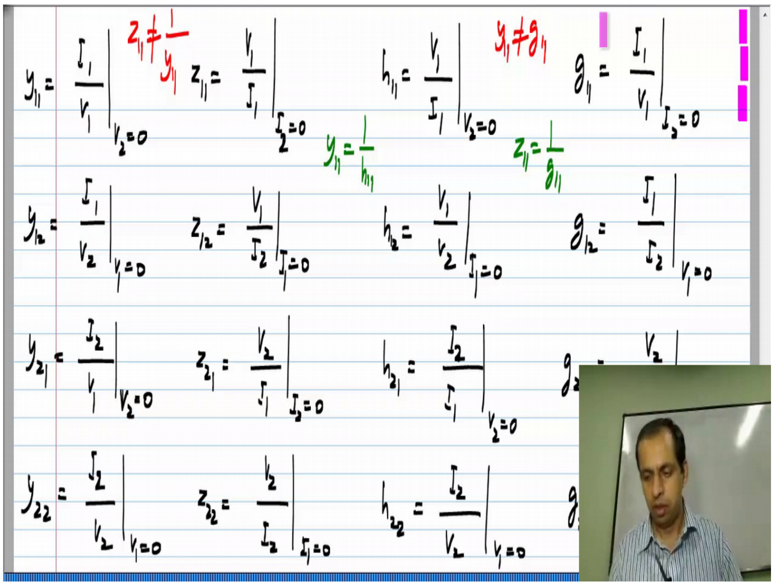

In this lesson, I will briefly discuss the relationship between different sets of parameters. Now given one set of parameters, you can find all the others also. All it entails is rearranging of the two equations, because for instance you would write for with y parametric equations, you would write currents as functions of voltages. Now if you rearrange the same thing, so that you have voltages as functions of a current I 1 and I 2, you get the z parameter set; instead if you have I 2 and V 1 as a function of I 1 and V 2 you get the x parameter set and so on. So, is just a matter of manipulating the equations.

Now what I wanted to show here is in this table I have listed all of the parameter definitions the way we major them that is we either open circuit or short circuit some port and take the ratio of voltage to current or current to voltage or ratio voltages or currents as appropriate. What I want to highlight is that node 2 of these are the same that is you may be majoring the same quantities, but there will be under different conditions. For instance, first of all let us look at y 1 1, we are taking the ratio I 1 by V 1; whereas for z 1 1 we are taking V 1 by I 1, but y 1 1 is measured with port 2 short circuited; z 1 1 is measured with port two open circuited. So, please do not make the mistake of confusing z 1 1 with 1 by y 1 1; the same thing goes for z 2 2 and y 2 2 as well.

Also if you look at expression y 1 is I 1 by V 1 and g 1 1 is also I 1 by V 1, but again they are measured under different conditions y 1 1 is with port 2 short circuited; and g 1 1 is with port 2 open circuited. So, y 1 1 is not equal to g 1 1, because although they are ratios of the same quantities, they are measured under different conditions. So, please do not make elementary mistakes like this, while converting from one parameter set to another or things like that. What is true is that y 1 is I 1 by V 1 with V 2 equal to 0 that is port 2 short circuited; h 1 1 is V 1 by I 1 with V 2 equal to zero also with port 2 short circuited, it is a different ratio though. So, we can clearly say that y 1 1 is 1 by h 11. Similarly both z 1 1 and g 1 1 are measured with port 2 open circuited. So, z 1 1 is 1 by g 1 1. So, these kinds of relationship, you can build up and you can also build up relationships for other parameters, but especially important note to make this type of mistake.

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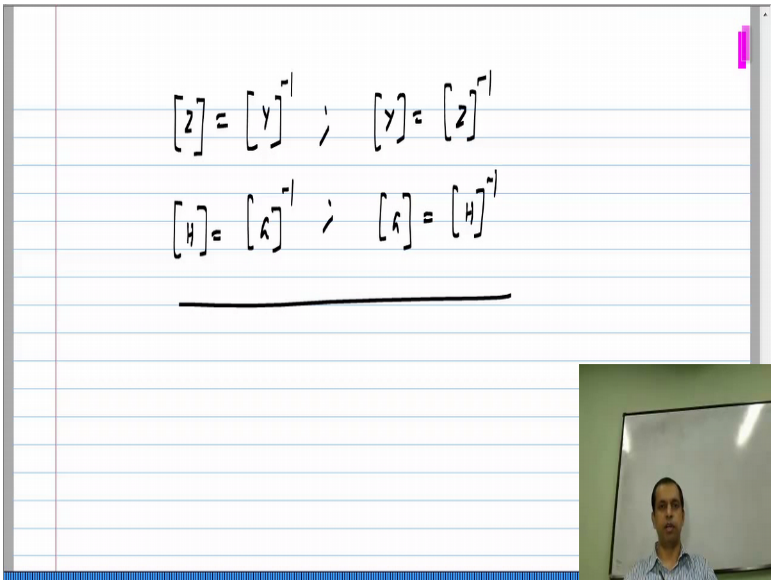

Now the other relationship between the entire sets, you already know. The Z parameter is basically the inverse of the Y parameter or Y is the inverse of Z matrix. Similarly, H is the inverse of G matrix or G is the inverse of H matrix. Now of course, if some of these matrices are not invertible, then you cannot invert it and find finite valued parameters. For instance, if H matrix is not invertible, you cannot have finite G parameters for that particular circuit, so that is mean that the circuit cannot be meaningfully represented by G parameters, but if they are invertible, you can use any of the four parameter sets for describing the circuit.