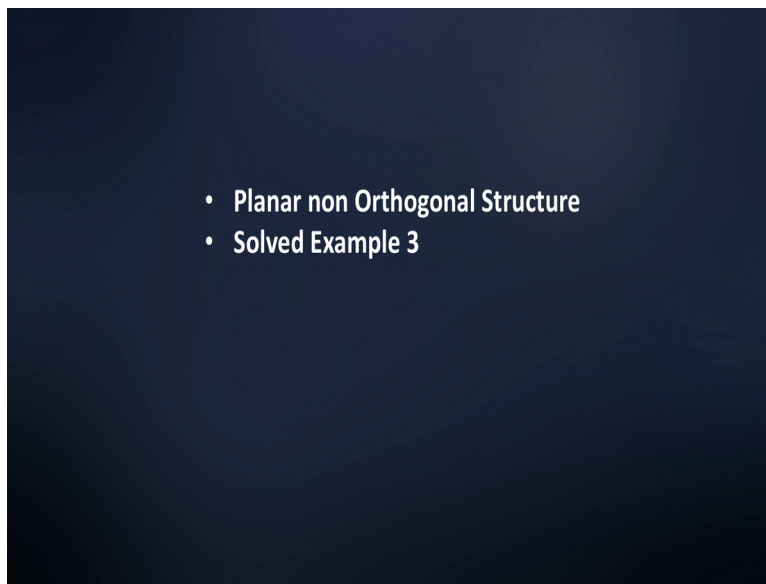**Computer Methods of Analysis of Offshore Structures**
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Module - 01
Lecture - 17
Non-orthogonal frame - Example 3

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Once we have K uu bar, then I can always find delta unrestrained as K uu bar inverse of the include. So, now, our aim is to find the joint load, look at the system of loading.

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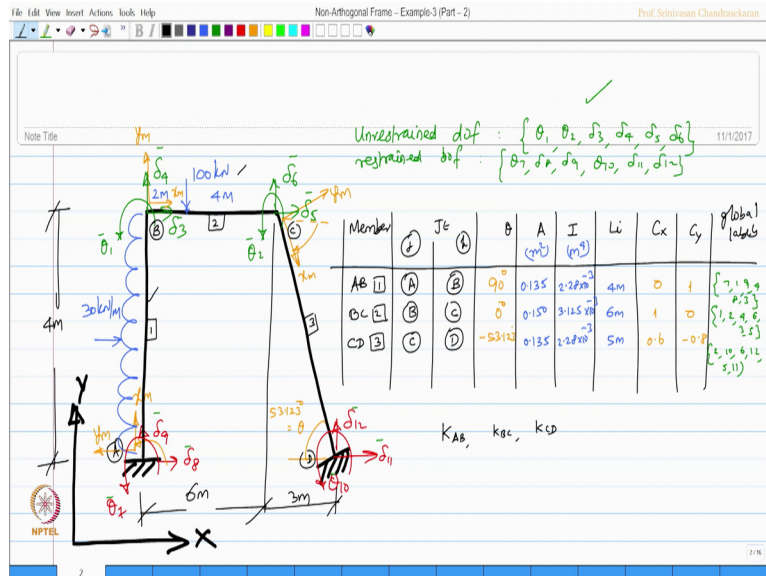
So, member AB has a member loading member BC has member loading; so, we have to find out the FEM for each one of them fixed end moments, let us take the member AB; let us take the member AB for example, say member AB.

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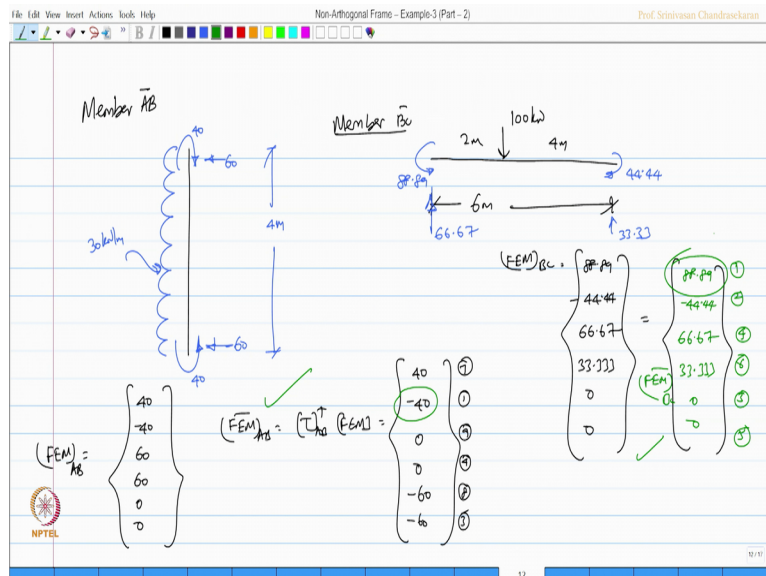
We have a vertical column subjected to uniform distributed load of intensity 30 kilo Newton per meter over height of 4 meters for this will generate end moments of this

order and if you quickly work out this values will be 40, 40, 60 and 60. Similarly for the member BC, the loading pattern is given like this, this is 6 meter long, this is the load of 100 kilo Newton, at 2 meter and 4 meter, we walk out; the fixed moments for this because of this loading this value will be 88.89, this will be 44.44 and this reaction will be 66.67 and this is going to be 33.33.

Let us write down the fixed end moments for this, fixed end moments local for the member AB could be you can see here; the degrees of freedom are compared with this problem, we can write this is as 40 minus 40, 60, 60, 0 and 0, the new transformation I can find FEM bar of the member A, B as T AB transpose of FEM which gets me FEM bar as 40 minus 40, 0, 0 minus 60 minus 60 of the labels 7, 1, 9, 4, 8, 3.

Similarly, FEM local of the member BC would be 88.89; 33.33; sorry 44.44 minus 66.67; 33.3330 and 0 and I do the same transformation; I get FEM bar which is same as this because the angle of inclination is 0 in this case and the labels are essentially 1 2 4 6 3 5.

So, I get the same values 88.81 minus 44.44; 66.67; 33.33 3 0 and 0 which will be FEM bar of the member BC, so I now FEM bar of AB FEM bar of BC. Now I can combine them and form a joint code vector; let us take for example, the joint code vector of the first row will be plus 40 that is reversal of this and minus 88.89 which I get minus 48.89 which I am getting here.

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So, this is nothing, but the J L; the joint code vector bar of the complete structure you can see there are 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 rows.

Now, I apply this equation del u bar will be K uu inverse bar of J L u bar. Apply this and get del u bar as 1 by e multiplier once I get this, then I apply M bar AB will be M bar AB will be k bar AB that is k global into del bar AB that is global displacement plus FEM bar of AB, I apply this equation M bar AB will be actually M 7, M 1, V 9, V 4, H 8, H 3 which will be given by these values which we are 10 from the program which will be able to get directly from the program.
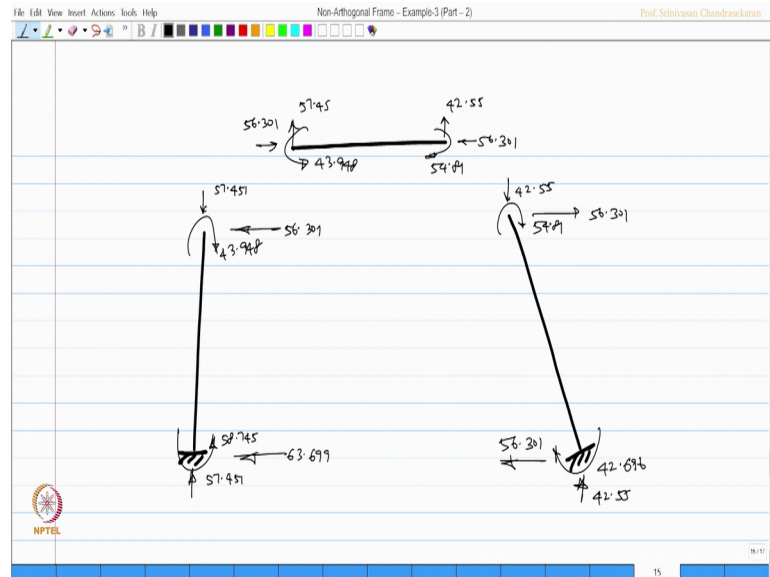
So, we try to plot and get the answers here this is for M bar AB member 1.

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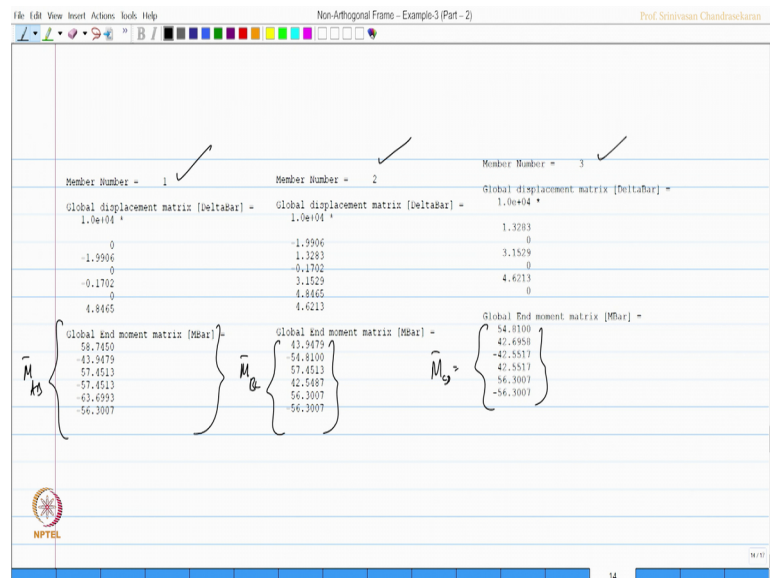
Then this is for M bar BC member 2 and this is for M bar BC; sorry, CD which is member 3; let us try to plot this values for the figure.

So, this is my system when let us incorporate these results and enter them here. So, if you look at this value plus 58.74. So, it is going to be anticlockwise 58.745 and the next one if you see minus; so, clockwise 43.948.

Then along y that see here plus 57. So, this is going to be plus 57.451 and this is minus 57.451 not minus its negative automatically, then the next one is minus 60 3. So, I will change the direction 63.699; 56.301, then we apply the next load for this member. So, this is 43.948 and 54.81, 56.301; 56.301, 57.45, 42.55 and this is going to be 42.55; sorry, 54.81 and 42.55 and 56.301 and this is further 42.696 and this is going to be 42.55 the plate load matches with this and we get the end reactions.
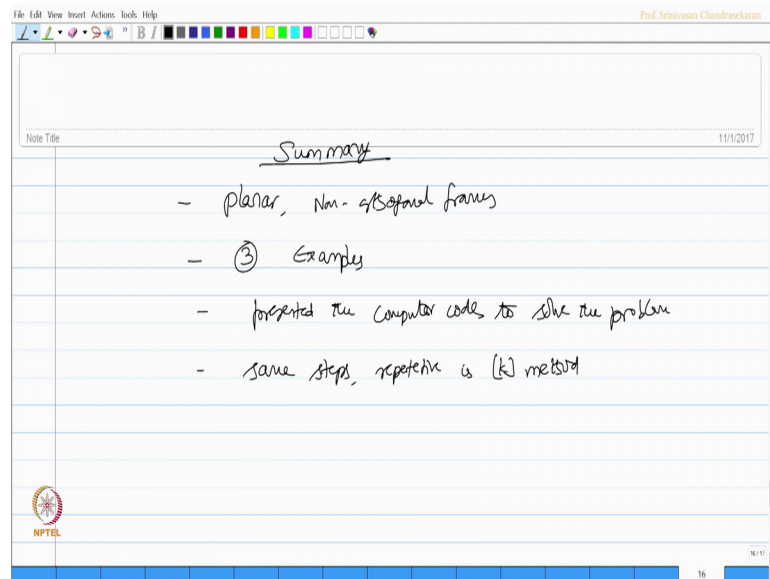
So, friends we discussed about the planar non orthogonal frames problem with three examples we also presented the computer code used to solve the problem. And we followed the same steps which are more or less repetitive in the stiffness method to solve this problem.

I hope you enjoyed this and you will try to solve much more problems in the same style and compare the answers with analytical solutions.

Thank you very much.