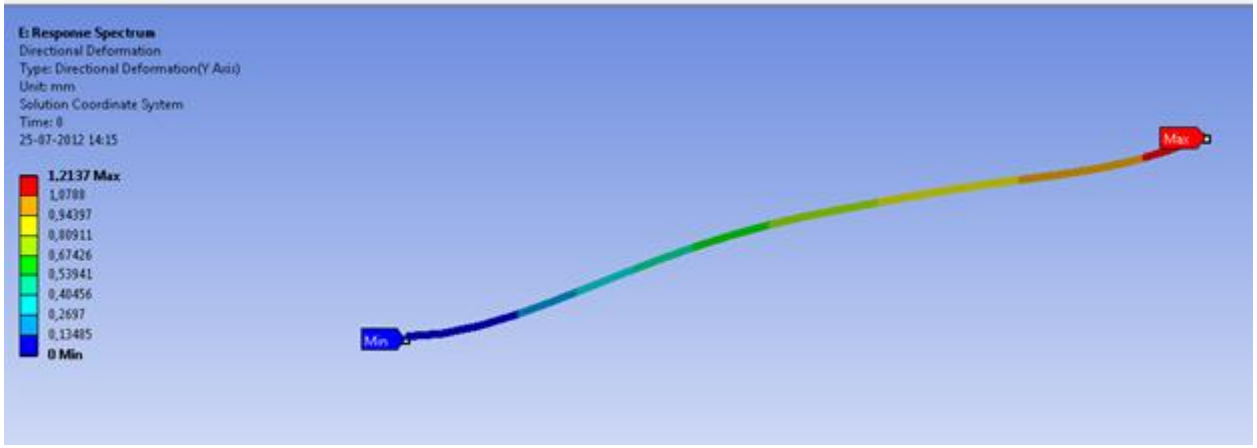
Response Spectrum analysis
Workbench 14.0



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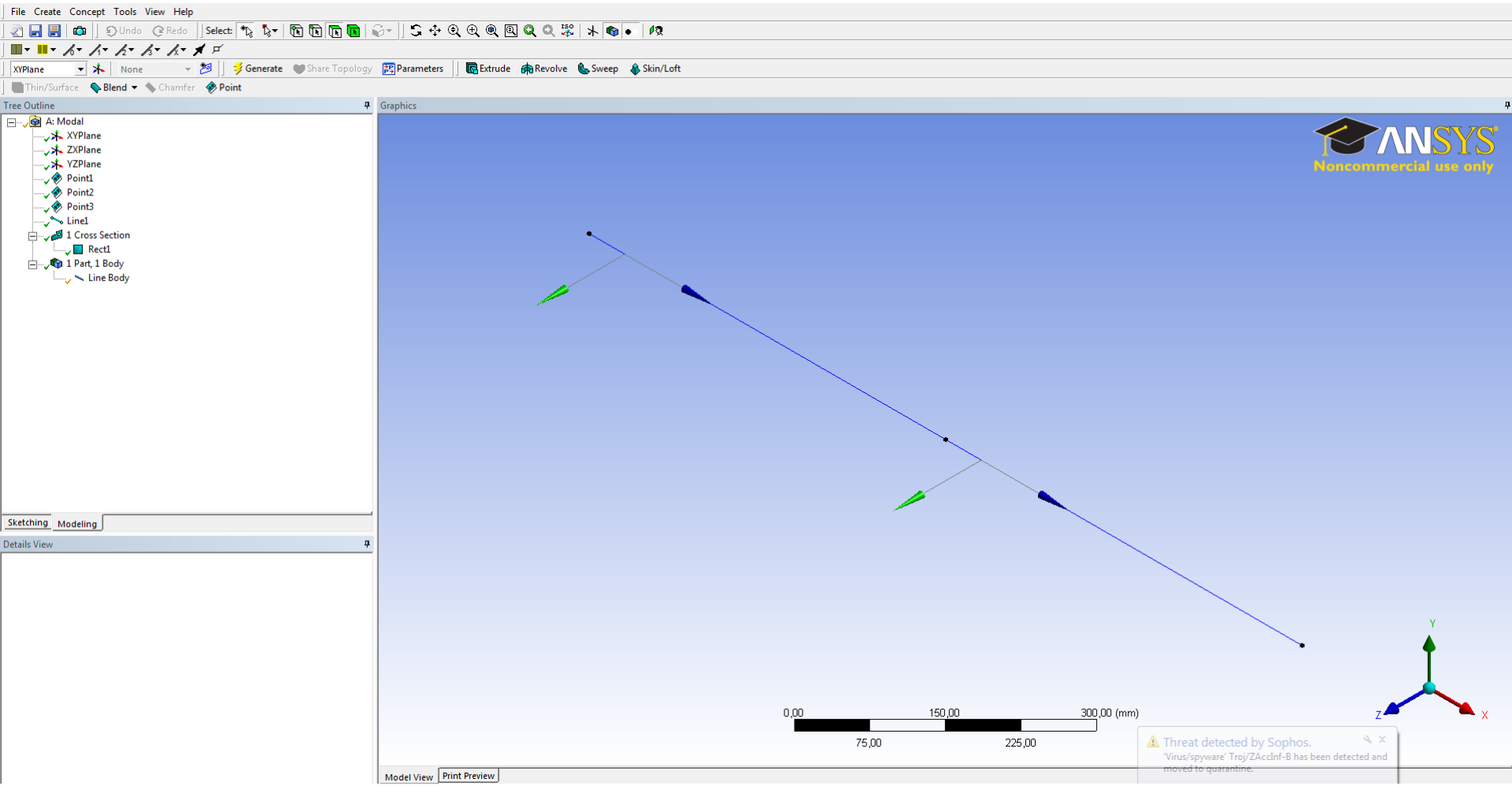
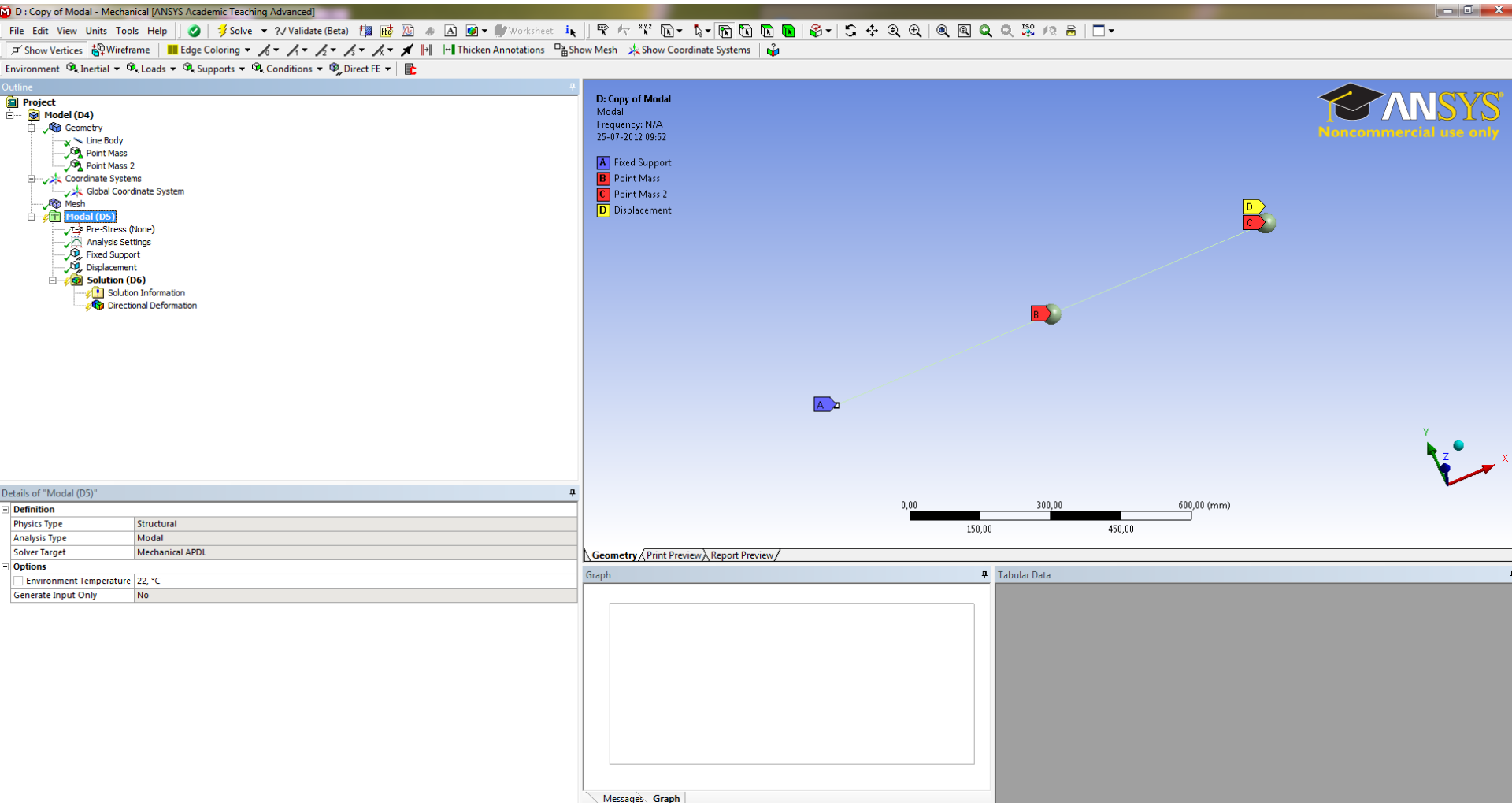
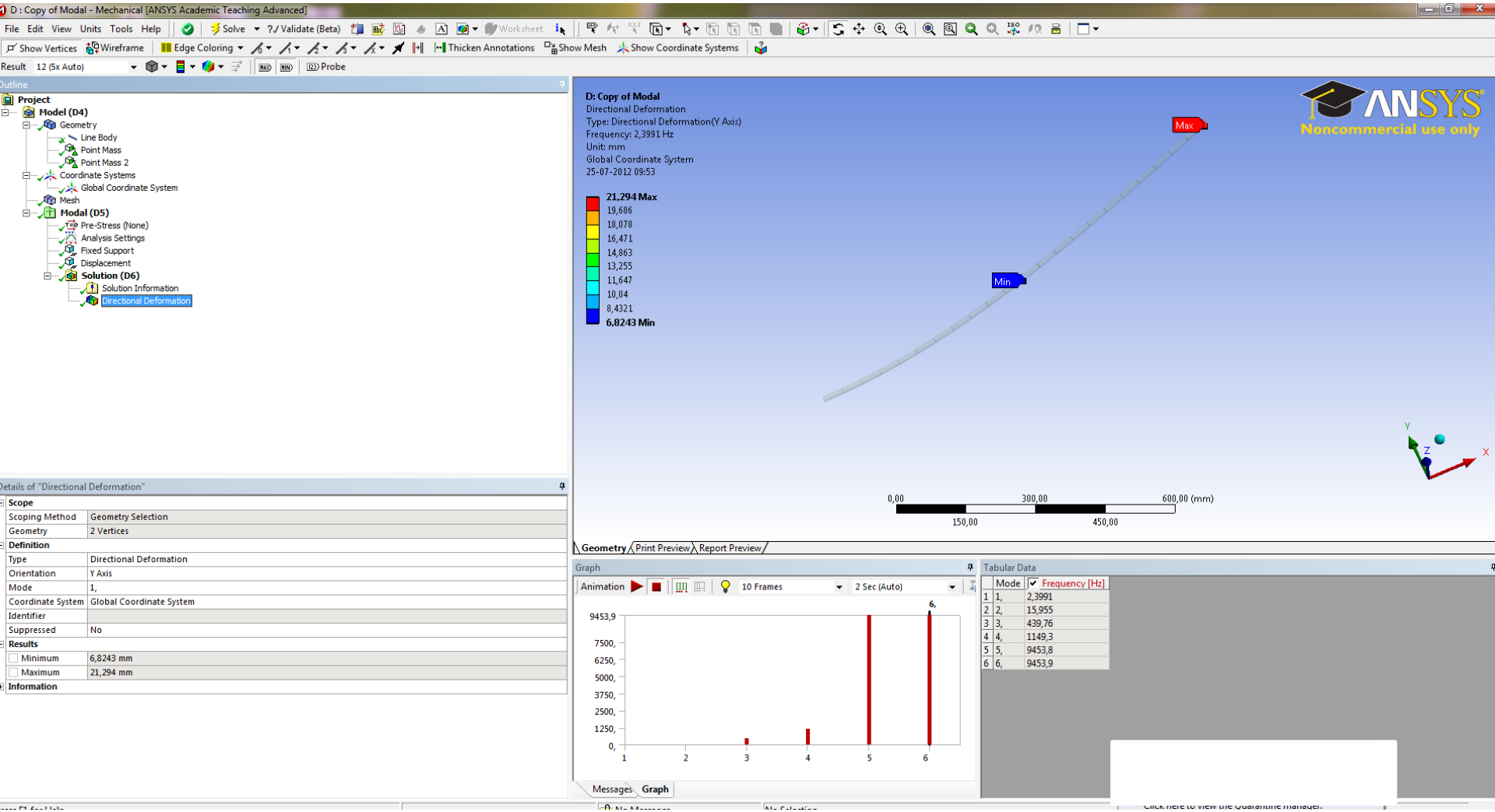


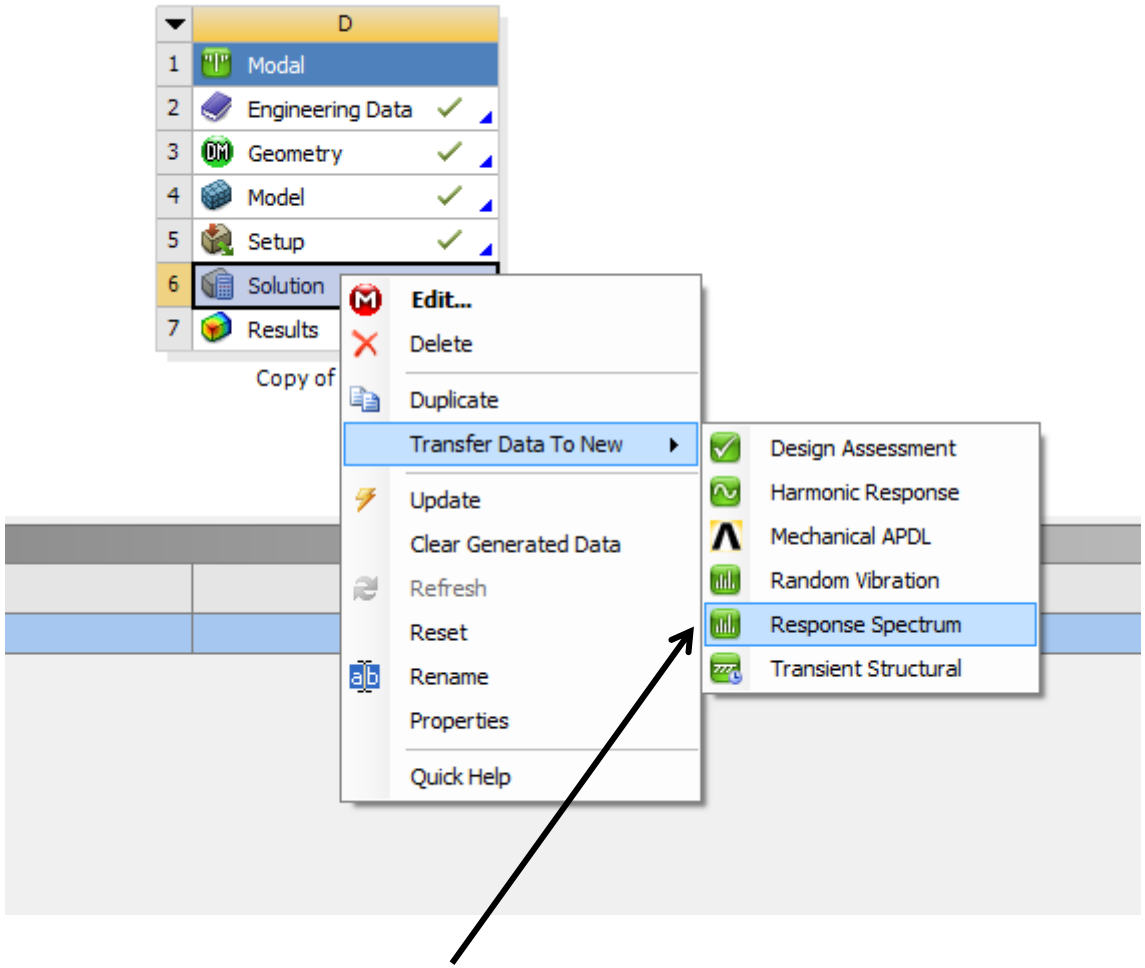
Make a beam model with the cross section dimension at 10X10mm and build the model with three point at a 500 distance. In this example the density of the beam is 1 kg/m^3



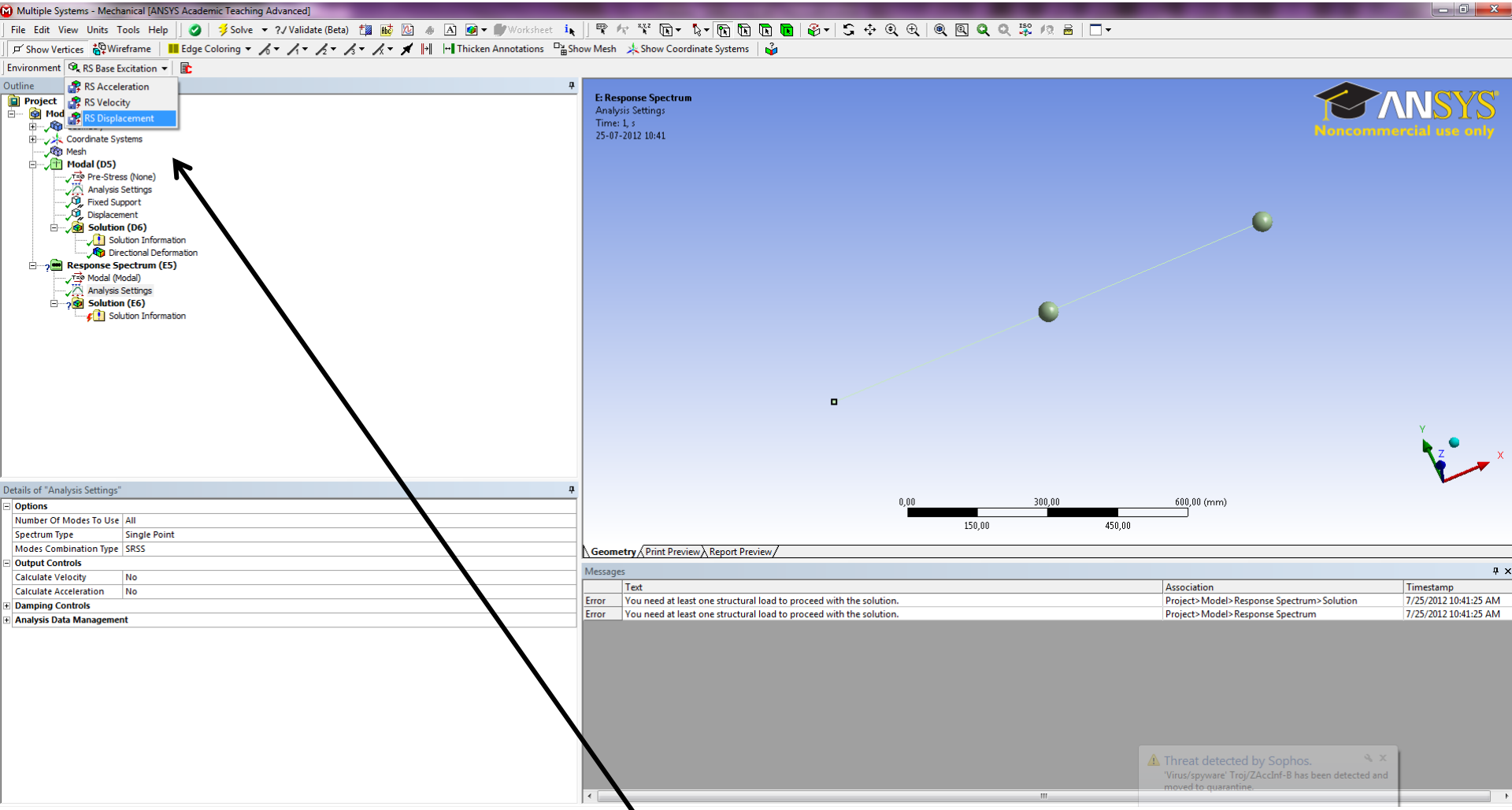
Setup the model with two mass point at 2 kg etch. Set the displacement in the z direction to zero to make a look a like 2D analysis. Add a Fixed support at the end of the beam and solve the system.



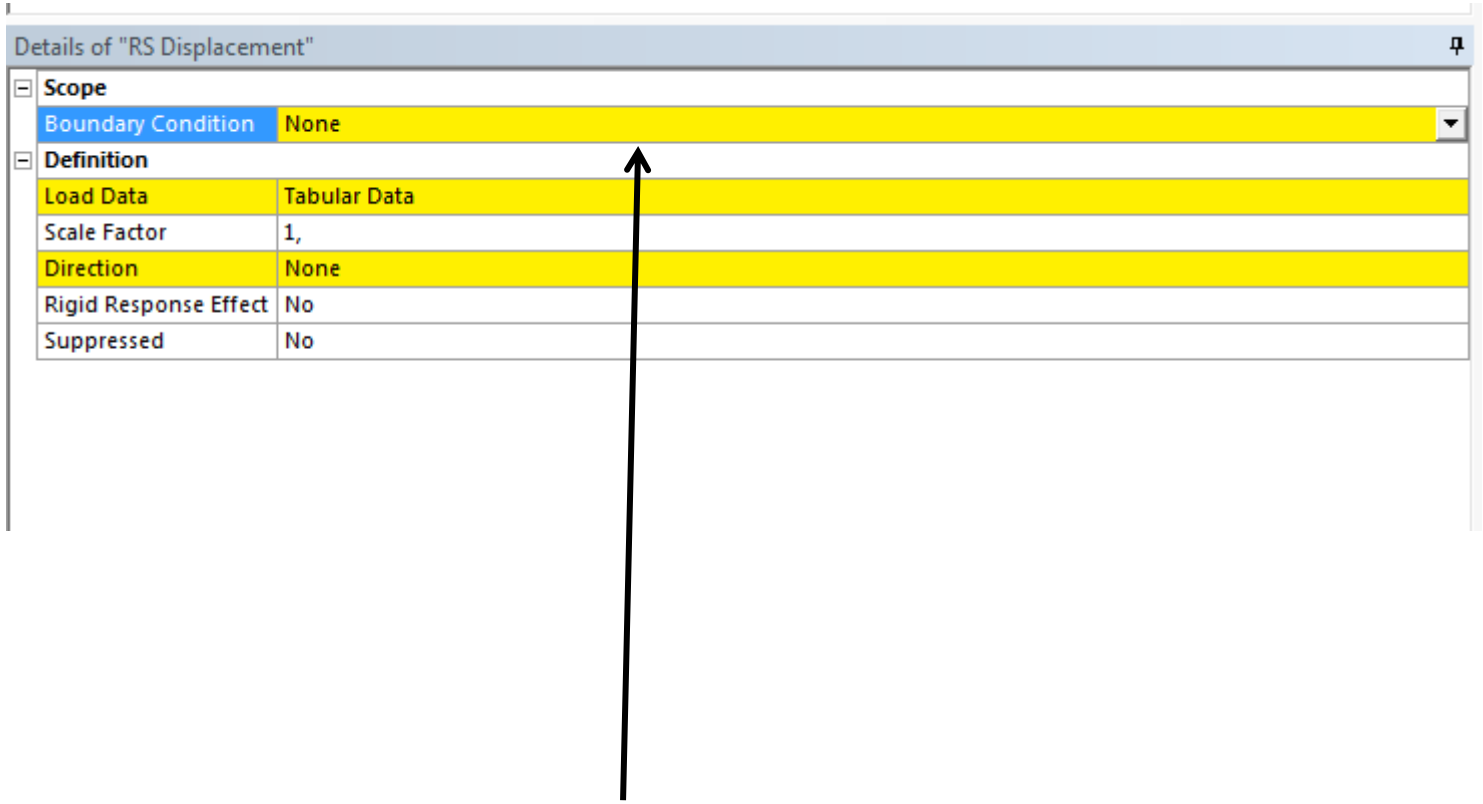
The Modal solution in the y direction



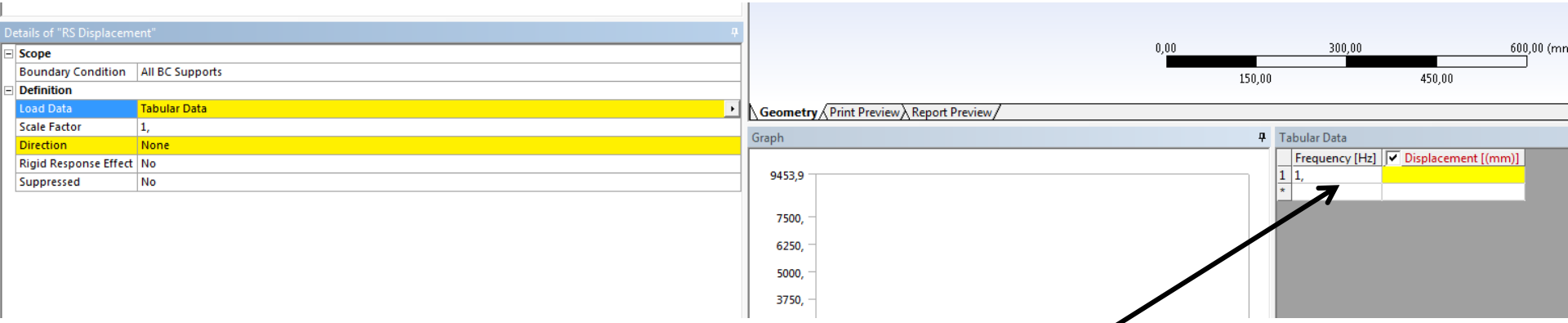
Then add a Response Spectrum from fra modal solution



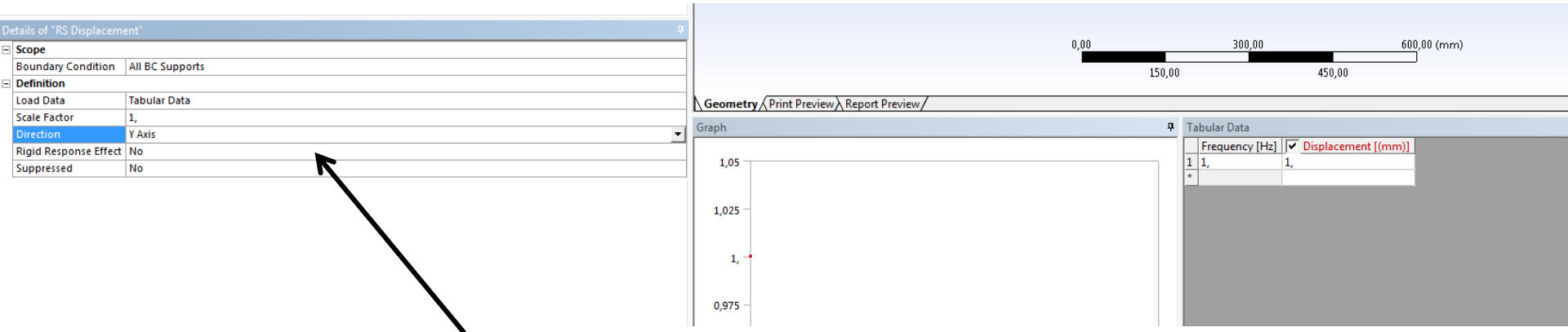
Then open the Response Spectrum and insert RS Displacment.



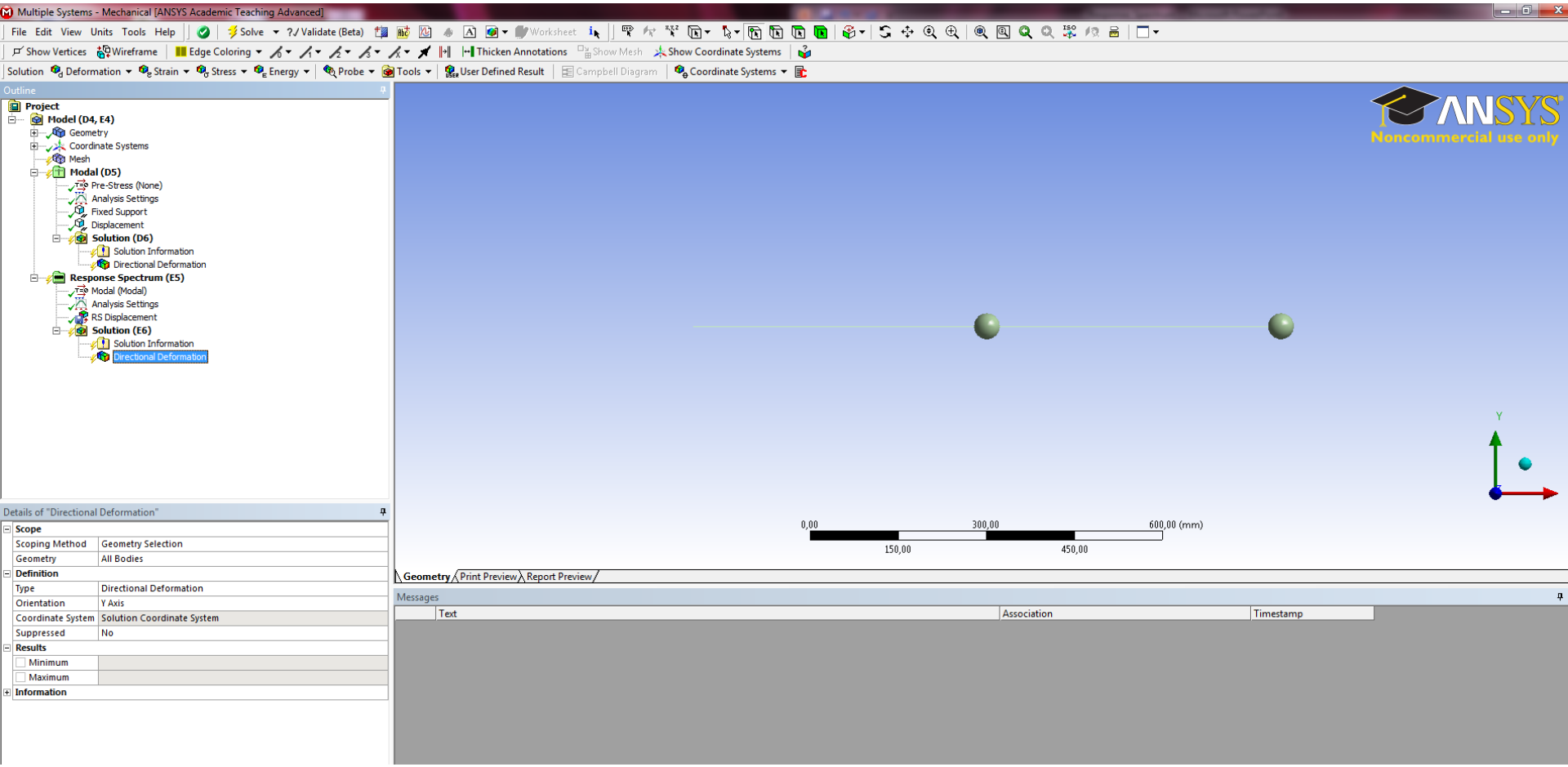
Then select ALL BC Support under Boundary condition



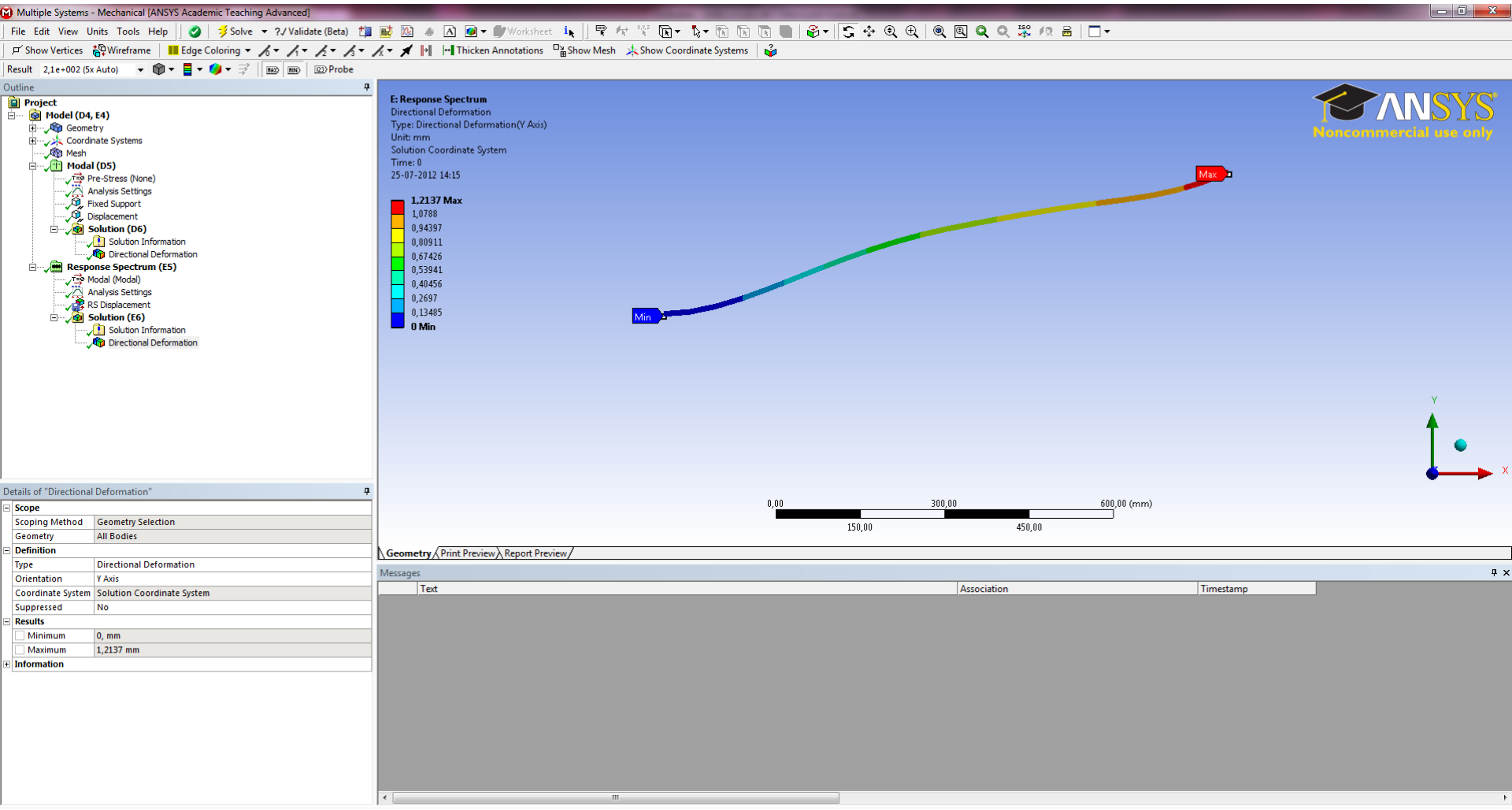
Insert the Response Data



And set the Direction Y axis



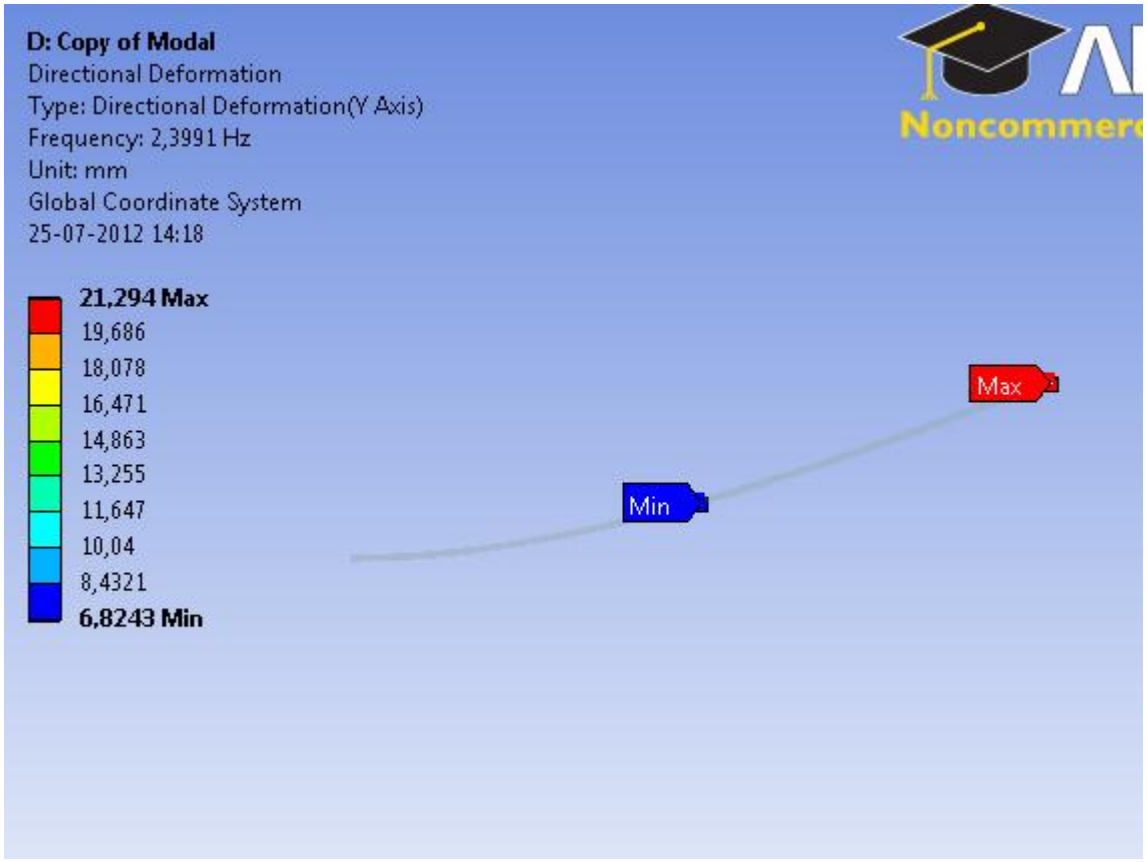
Plot the y deformation and solve



And the result. It is also possible to calculate the result by hand.

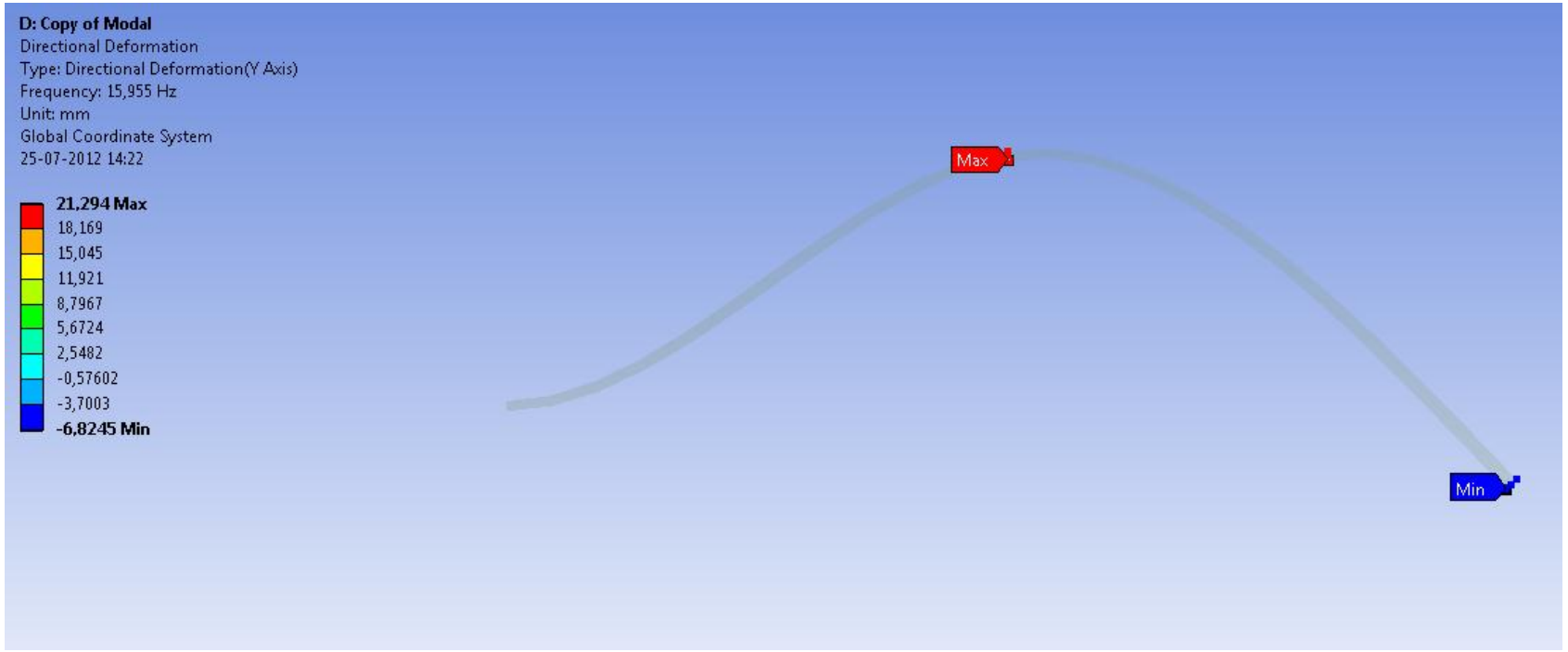
We will use the first two modes form the modal analysis and calculate on two points.

$$Mode\ 1 = \begin{pmatrix} 0 \\ 6.8243 \\ 21.294 \end{pmatrix}$$



We will use the first two modes form the modal analysis and calculate on two points.

$$Mode\ 2 = \begin{pmatrix} 0 \\ 21.294 \\ -6.8245 \end{pmatrix}$$



Displacement mode 1 and mode 2 from the modal analysis

$$\theta_1[Mode\ 1] = \begin{pmatrix} 0 \\ 6.8243 \\ 21.294 \end{pmatrix} \qquad \theta_2[Mode\ 2] = \begin{pmatrix} 0 \\ 21.294 \\ -6.8245 \end{pmatrix}$$

The weight vector

$$w = \begin{pmatrix} 0 \\ 2 \\ 2 \end{pmatrix}$$

Check Mass Participation

$$M_k = \frac{(\sum_{i=1}^{n} W_i \theta_{ik})^2}{\sum_{i=1}^{n} W_i (\theta_{ik})^2} \qquad M_{Participation} = \sum_{k=1}^{m} M_k$$

	$\theta_1[Mode\ 1]$			$\theta_2[Mode\ 2]$		
W_i	θ_1	$W_i\theta_{ik}$	$W_i(\theta_{ik})^2$	θ_2	$W_i\theta_2$	$W_i(\theta_2)^2$
0	0	0	0	0	0	0
2	6,8243	13,6486	93,14214	21,294	42,588	906,8689
2	21,294	42,588	906,8689	-6,8245	-13,649	93,1476
$\sum SUM$		56,2366	1000,011		28,939	1000,016

Check Mass Participation

Mode	1	2
M_k	3,16252	0,837452

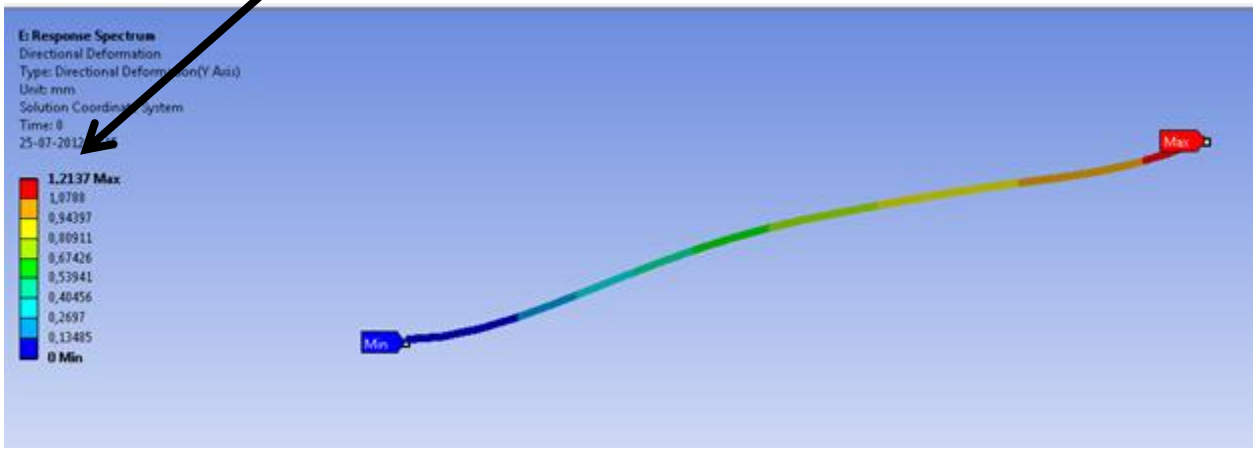
$$M_{Participation}=3.16252+0.837452=3.999$$

$$P_k = \frac{\sum_{i=1}^{n} W_i\theta_{ik}}{\sum_{i=1}^{n} W_i(\theta_{ik})^2}$$

Calculate mode participation factors			
Mode	1	2	
P_k	0,056236	0,028939	

$P_k \theta_i =$

	Mode 1	Mode 2
	0	0
Node	0,383771	0,616217
Node	1,197489	-0,19749
SQSS	1,213665	



References:

[1] http://www.edr.se/blogg/blogg/ansys_tutorial_earthquake_analyses_in_workbench

[2] Seismic Analysis of Multi-storied RC Building *Presented by* Rahul Leslie
http://www.google.dk/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=4&ved=0CFcQFjAD&url=http%3A%2F%2Fwww.sefindia.org%2Fforum%2Fdownload.php%3Fid%3D4798%26sid%3D87dfeb5a80a2afd5ffc986a87fe604c5&ei=Z-EPUNb0KJDE4gSXv4GAAQ&usg=AFQjCNEkklJ5zCZAq_5sgDQFGLZiMT7XNw&sig2=L5pr_eCHq4pakW6SIxmCEA