VIB : MDOF systems

Number of participants: 29

1. The mode shapes and eigenfrequencies of a system are determined by (K and M are the stiffness and mass matrices)

17 correct answers out of 22 respondents

	Answer	%	Votes
	Calculating the eigenvalues of the stiffness matrix K of the system	5%	1 vote
✔	solving a generalized eigenvalue problem of the type (K-w^2M) {Phi} = 0	77%	17 votes
	Calculating the eigenvalues of the mass matrix M of the system	14%	3 votes
	Calulating w=K/M	5%	1 vote

2. If a system has n degrees of freedom, it has

20 correct answers out of 23 respondents

	Answer	%	Votes
	2n natural frequencies	0%	0 votes
✔	n natural frequencies	87%	20 votes
	(n + the number of excitations) natural	13%	3 votes

	frequencies		
	it depends on the type of system	0%	0 votes

3. The mode shapes are orthogonal with respect to the

3 correct answers out of 22 respondents

✔	stiffness matrix	45%	10 votes
✔	mass matrix	41%	9 votes
	damping matrix	36%	8 votes

4. The interest of projecting the equations of motion in the modal domain is to:

18 correct answers out of 24 respondents

	reduce the number of equations to solve	17%	4 votes
✔	decouple the equations of motion and facilitate solving them	75%	18 votes
	work with physical quantities for a better understanding of the system's behavior	8%	2 votes

5. Which of these quantities is a global quantity for a given structure

4 correct answers out of 22 respondents

	Answer	%	Votes
✔	the eigenfrequency	68%	15 votes
	the anti-resonance frequency	9%	2 votes
✔	the damping coefficient	45%	10 votes

6. An anti-resonance happens when

18 correct answers out of 21 respondents

	Answer	%	Votes
	The contribution to the response of the two close modes as equal amplitude and equal phase	5%	1 vote
✔	The contribution to the response of the two close modes has equal amplitude and opposite phase	86%	18 votes
	The displacement is zero for the two closest modes	10%	2 votes

7. Complete following statement about anti-resonances for a 2DOF system (X1,X2)?

0 respondent

When X2 has an anti-resonance at frequency f_0 it will not displace when excited by a(n) **harmonic** (0) force with a frequency **equal to f_0** (0) and X1 **will** (0) displace.

8. What kind of hypothesis can be made on the damping matrix to decouple the equations of motion in the modal domain ?

3 correct answers out of 22 respondents

✔	Rayleigh Damping	64%	14 votes
	Lagrange Damping	14%	3 votes
✔	Modal damping	36%	8 votes
	Viscous damping	36%	8 votes

9. How many mode shapes and eigenfrequencies does this building simplified model have ?

15 correct answers out of 17 respondents

	one	0%	0 votes
	three	0%	0 votes
✔	five	88%	15 votes
	an infinity	12%	2 votes

10. If this system is excited with an harmonic force applied to the bottom mass, whose frequency is close to the first natural frequency, the motion will correspond to

9 correct answers
out of 15 respondents

✔	The first mode shape where the two masses move in phase	60%	9 votes
	The second mode shape where the two masses move out of phase	27%	4 votes
	A combination of the two modeshapes	13%	2 votes

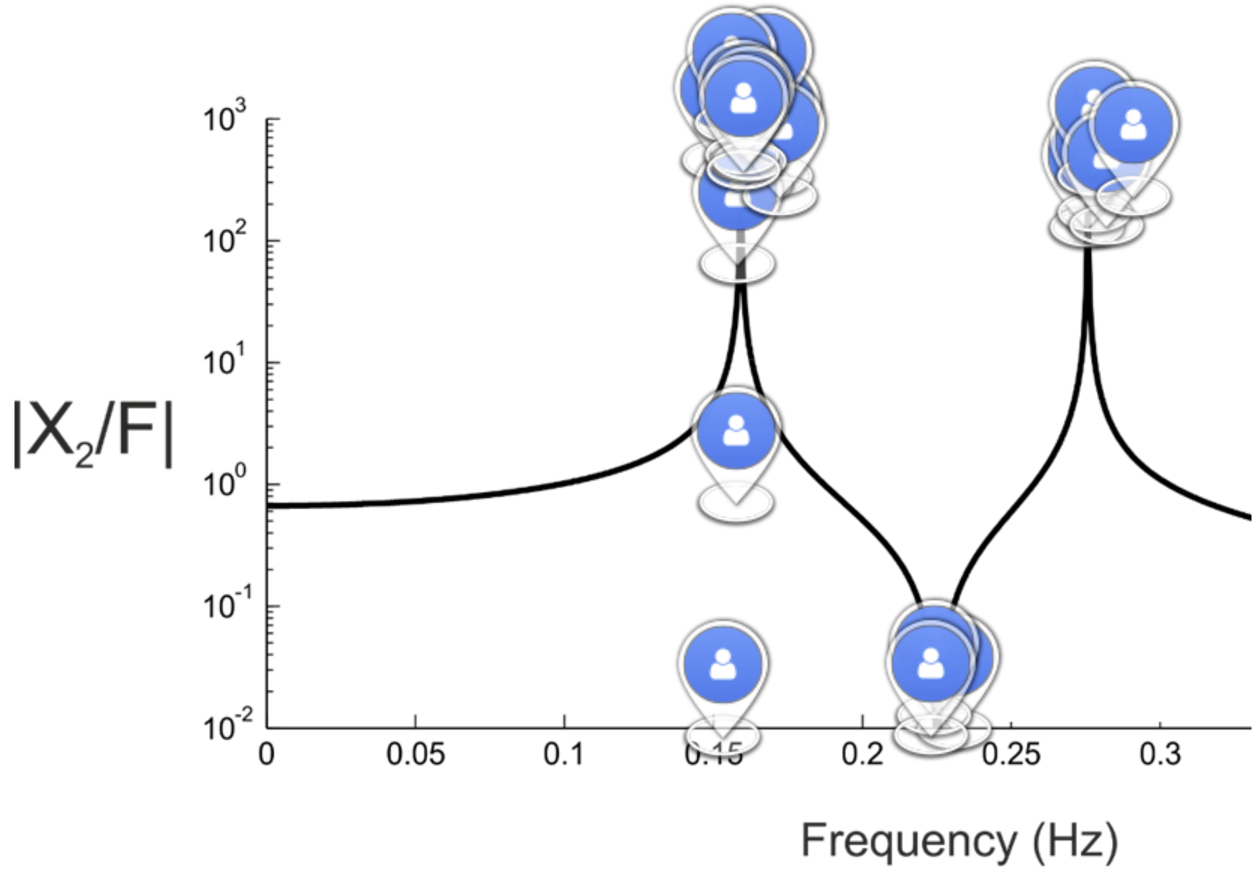
11. If this system is excited with an harmonic force applied to the bottom mass, whose frequency is the average of the first and second natural frequencies of the system, the motion will correspond to

9 correct answers
out of 16 respondents

	The first mode shape where the two masses move in phase	19%	3 votes
	The second mode shape where the two masses move out of phase	25%	4 votes
✔	A combination of the two mode shapes	56%	9 votes

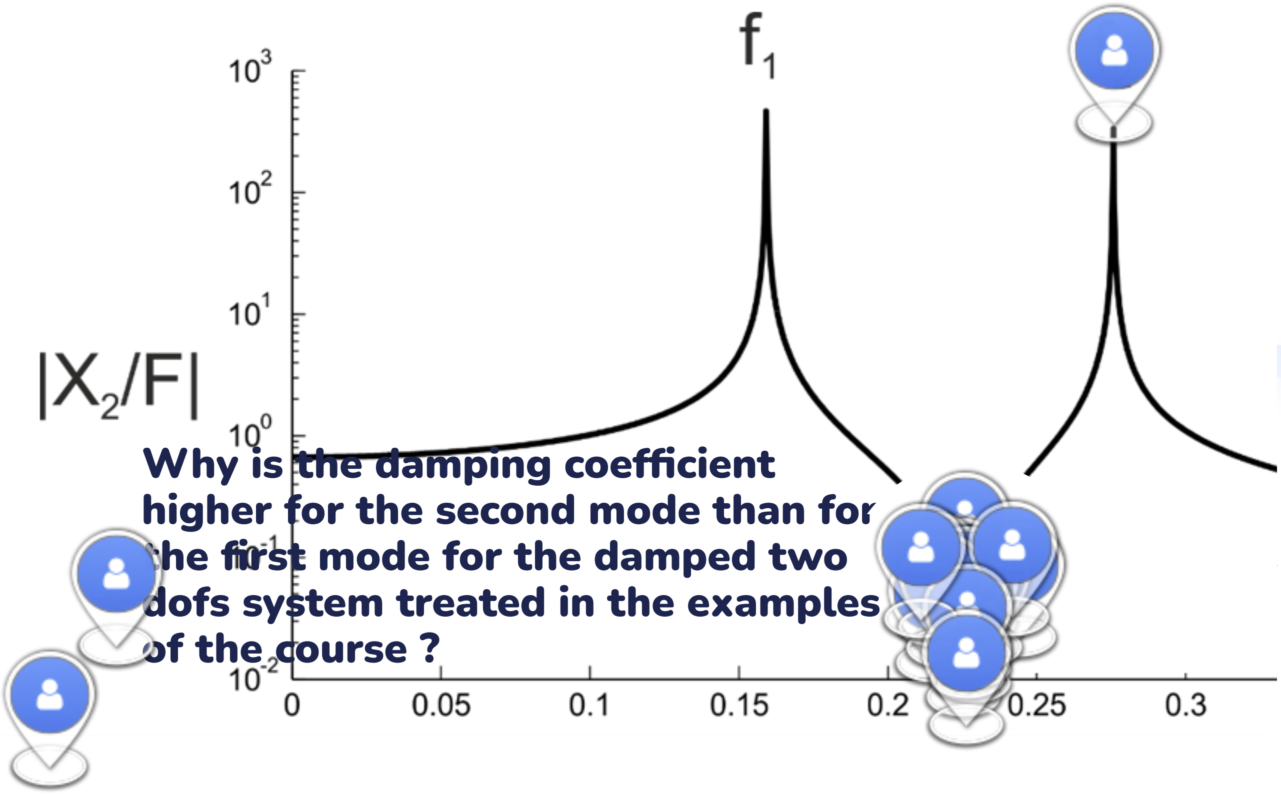
12. Where are the resonant frequencies of the 2 DOFs system on this graph ?

22 respondents



13. **Where is the anti-resonance of the 2 DOFs system on this graph ?**

20 respondents



Why is the damping coefficient higher for the second mode than for the first mode for the damped two dofs system treated in the examples of the course ?

No answers in this question

15. **This is the impulse response of a damped two dofs system. Is it possible to extract the information on the first natural frequency and damping from this curve in a simple way ?**

20 correct answers
out of 23 respondents

	Answer	%	Votes
✔	Yes	87%	20 votes
	No	13%	3 votes

16. How would you extract the first natural frequency from the impulse response ?

0 respondent

No answers in this question

17. This is the impulse response of a damped two dofs system. Is it possible to extract the information on the second natural frequency and damping from this curve ?

13 correct answers
out of 19 respondents

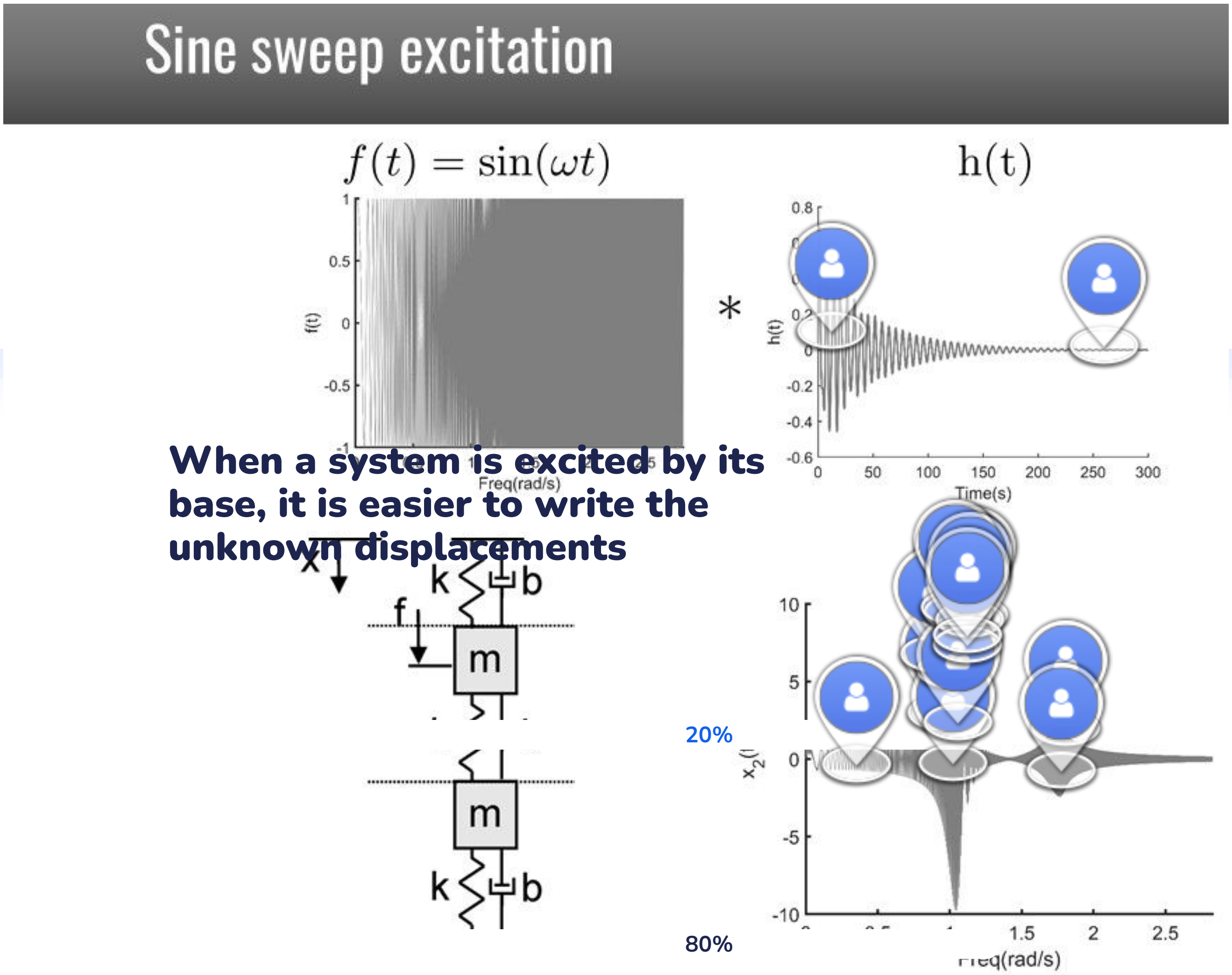
Yes, you can see the response of the second mode very	5%	1 vote

clearly.

✔	Yes, while you might not see it well, all information on the second mode is also contained in this response	68%	13 votes
	No, impulse responses show only the response from one mode at a time	26%	5 votes

18. This is the time domain response of a damped 2 DOFs system under sine sweep excitation. Where do you see the resonances on the time domain response ?

20 respondents



When a system is excited by its base, it is easier to write the unknown displacements

20%

80%

in mm instead of m 0% 0 votes

20. When doing so, the equation of motion is equivalent to the case of an applied force which is

7 correct answers
out of 16 respondents

✔	proportional to the applied acceleration	44%	7 votes
	inversely proportional to the applied acceleration	25%	4 votes
	proportional to the applied displacement	31%	5 votes