Mechanical System Dynamics

Exam Simulation

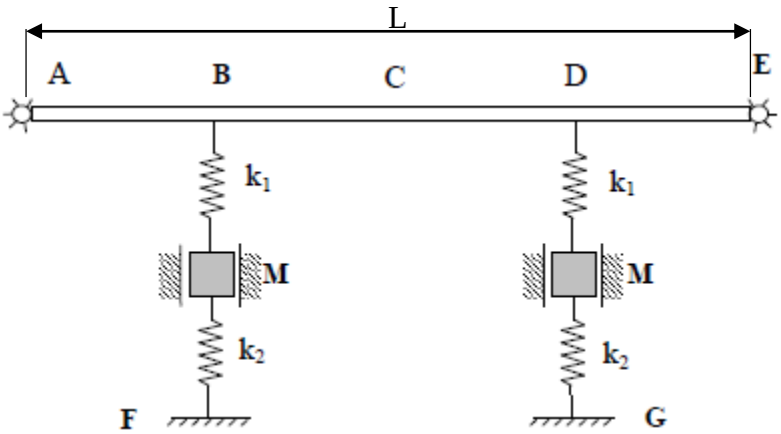

Figure 1. Structure.

Structural and geometrical properties:

m = 59 kg/m	EA = 1.58E9 N	EJ = 6.3E6 N·m^2
L = 1.2 m		AB = DE = 0.3 m
M = 200 kg	k_1 = 50E6 N/m	k_2 = 20E6 N/m

1. Build a FEM model for the structure depicted in Figure 1, reliable in the frequency range 0 – 1500 Hz. Save the figure of the undeformed structure in a file .fig as SNxxx1.fig where S is the first letter of your surname, N is the first letter of your name and xxx are the last three numbers of your ID number (Matricola) (example: Bruni Stefano 123456: BS456).
2. Compute the first 4 natural frequencies and mode shapes. Save the results in four files .fig as SNxxx2.fig, SNxxx3.fig, SNxxx4.fig and SNxxx5.fig.
3. Assuming a Rayleigh model for damping, say $[C] = \alpha\cdot[M]+\beta\cdot[K]$, with coefficient $\alpha = 0\ s^{-1}$ and coefficient β = 0.1E-5 s, compute the Frequency Response Function in the band 0 – 1500 Hz (resolution: 1 Hz) of vertical displacement of B and C due to a vertical force applied in C. Save the results as SNxxx6.fig and SNxxx7.fig. **Comment the results** (see table 1).
4. Compute the Frequency Response Function in the band 0 – 1500 Hz (resolution: 1 Hz) of vertical constraint force in F due to a vertical force applied in C. Save the result as SNxxx8.fig.
5. Compute the Frequency Response Function in the band 0 – 1500 Hz (resolution: 1 Hz) of vertical displacement of D due to an imposed vertical displacement in F. Save the result as SNxxx9.fig.
6. Compute the vertical force applied by the spring k_1 in B due to the imposed vertical displacement in F in the band 0 – 1500 Hz (resolution: 1 Hz). Save the result as SNxxx10.fig.
7. Define a structural change able to decrease of 50% the maximum amplitude of the vertical displacement of B due to the force introduced in item 3. A maximum change of natural frequencies of the system of ±2% is allowed. Save the Frequency Response Function of the modified structure as SNxxx11.fig.

Table 1

Surname	**Name**	**ID number/ code SNxxx**
1.		
File name .inp		
2.		
1st Natural Frequency [Hz]		
2nd Natural Frequency [Hz]		
3rd Natural Frequency [Hz]		
4th Natural Frequency [Hz]		
3.		
Maximum amplitude of the vertical displacement in B		
Maximum amplitude of the vertical displacement in C		
Comment figures SNxxx6 and SNxxx7		
4.		
Maximum amplitude of the vertical force in F		
5.		
Maximum amplitude of the vertical displacement in D		
6.		
Maximum amplitude of the vertical force in B		
7.		
File name .inp		
Maximum amplitude of the vertical displacement in B		

SUBMISSION OF RESULTS:
Create a MATLAB file with the commands needed to solve the exercise and save it as SNxxx.m (e.g. for Bruni Stefano 123456: BS456.m).
Compress all the results to be submitted (SNxxx.m, *.inp, and .fig files) in a file saved as SNxxx.zip (or SNxxx.rar) that must be submitted by uploading it on Beep, following the instructions below reported:

- Connect to website https://beep.metid.polimi.it/ and login by using your Person Code and Password;
- Select the course “Dinamica dei Sistemi Meccanici” and select the Tab “Consegne”;
- Select the folder “Test_15_06_2015” and select the Tab “Aggiungi” and “Documento singolo”;
- Fill the field “Titolo” with the code SNxxx (e.g. for Bruni Stefano 123456 BS456);
- Select your compressed file SNxxx.zip by clicking on “Sfoglia” and corfirm the upload by clicking on “Pubblica”