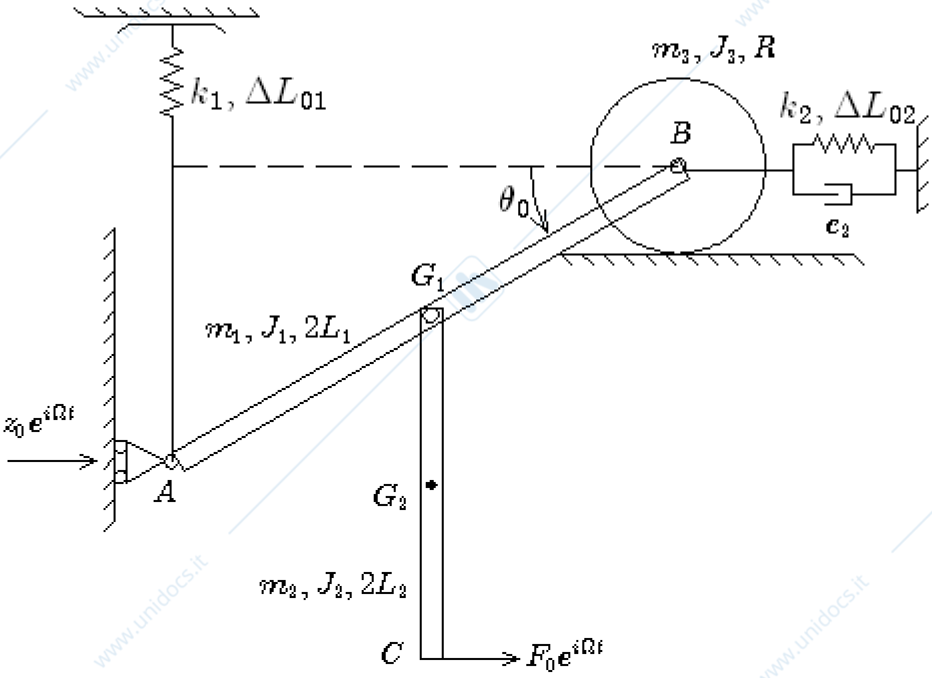
Mechanical Systems Dynamic

November 24th, 2016 – Version B



m_1 = 10 kg	k_1 = 7500 N/m
m_2 = 15 kg	k_2 = 7500 N/m
m_3 = 10 kg	ΔL_{01} = 0.0106 m
J_1 = 0.8 kgm^2	ΔL_{02} = 0.01 m
J_2 = 0.8 kgm^2	c_2 = 5 Ns/m
J_3 = 0.3 kgm^2	$\theta_0 = \pi/6$ rad
L_1 = 0.75 m	
L_2 = 0.5 m	
R = 0.25 m	

The mechanical system in the picture lays in the vertical plane and is shown in its equilibrium position. Cart A is moving along a vertical plane and it is also connected to the ground by means of a vertical spring. The right extremity of the AB bar is connected to the center of the disk, which rolls without sliding along a horizontal plane. The students are requested to:

1. Write the surname, name, identification number and SNxxx code (see note below) on the top of first page of each sheet and leave blank the field named *Nr*. The sheet with uncompleted personal data may be not corrected. For environmental reasons the students are also kindly requested to write all of the four pages of each sheet before using another one.
2. Write the linearized equations of motion around the given static configuration;
3. Compute the natural frequencies and modes of vibrations;
4. Compute the Frequency Response Function (in the range 0 – 10 Hz, step = 0.01 Hz) applying the horizontal harmonic force $F_0 e^{i\Omega t}$ at the point C. Output: the rotation of the disk and the horizontal displacement of point G_2. Save the graphical results as SNxxx1.fig and SNxxx2.fig, with S the first letter of your surname, N the first letter of your name and xxx are the last three digits of your identification number (e.g. for Bruni Stefano 123456: BS4561.fig and BS4562.fig)
5. Compute the Frequency Response Function (in the range 0 – 10 Hz, step = 0.01 Hz) applying the horizontal constraint displacement $z_0 e^{i\Omega t}$ to the cart A. Output: the horizontal displacement of point G_2 and the force transmitted by the spring k_1. Save the graphical results as SNxxx3.fig and SNxxx4.fig
6. Compute the static preload of the k_1 spring when the angle θ_0 is $\pi/4$ and the preload ΔL_{02} of the second spring is unchanged. Write the numerical result on the sheets of the solution, together with the equations used to find this answer.
7. Compute the Frequency Response Function (in the range 0 – 10 Hz, step = 0.01 Hz) applying the horizontal harmonic force $F_0 e^{i\Omega t}$ at the point C. Output: the horizontal component of the constraint force in the hinge B. Save the graphical results as SNxxx5.fig.

Note: Please collect the Matlab's script file relative to the numerical solution of the exercise and save it with name SNxxx.m, with S the first letter of the surname, N the first letter of the name and xxx the last three digits of the matriculation number (e.g. for Bruni Stefano 123456: BS456.m). It is mandatory that all of the files (.fig e .m) have to be compressed (please select either the .zip or the .rar format) in a file named SNxxx.zip (o SNxxx.rar), which has to be uploaded on Beep. Each student is requested to:

1. Connect to the site https://beep.metid.polimi.it;
2. Enter the portal using the identification code and password;
3. Select the section Homework of the course DYNAMICS OF MECHANICAL SYSTEMS (BRUNI STEFANO);
4. Select the folder *Test Nov. 24 2016 BL27.02-B*, *Test Nov. 24 2016 BL28.11-B*, *Test Nov. 24 2016 BL28.21-B* according to the classroom
5. Click the button Add and select Single document;
6. Browse the compressed file SNxxx.zip using the button Browse… (or Sfoglia…)
7. Fill the Title field writing the code SNxxx (e.g. for Bruni Stefano 123456: BS456);
8. Confirm the procedure clicking the button Publish.