MECA-H303 TP4

Tuned Mass Damper

The following shaker/beam system has been solved in a previous exercise session. We are now interested in adding a Tuned Mass Damper (TMD) that would reduce the vibrations of the beam. For this system we ask you:

1. What is the stiffnes of the undamped TMD that would cancel the vibration at the natural frequency of the system ?
2. What would be the stiffness and damping of an optimally designed damped TMD ?
3. If given the choice, would you use a damped or undamped TMD for this system ? Why ? What would be a reasonnable range for the mass ratio μ ?

Additional details for the exercise:

- The mass of the TMD is m_e
- The final answer should be expressed as a function of the coordinates on the schematic

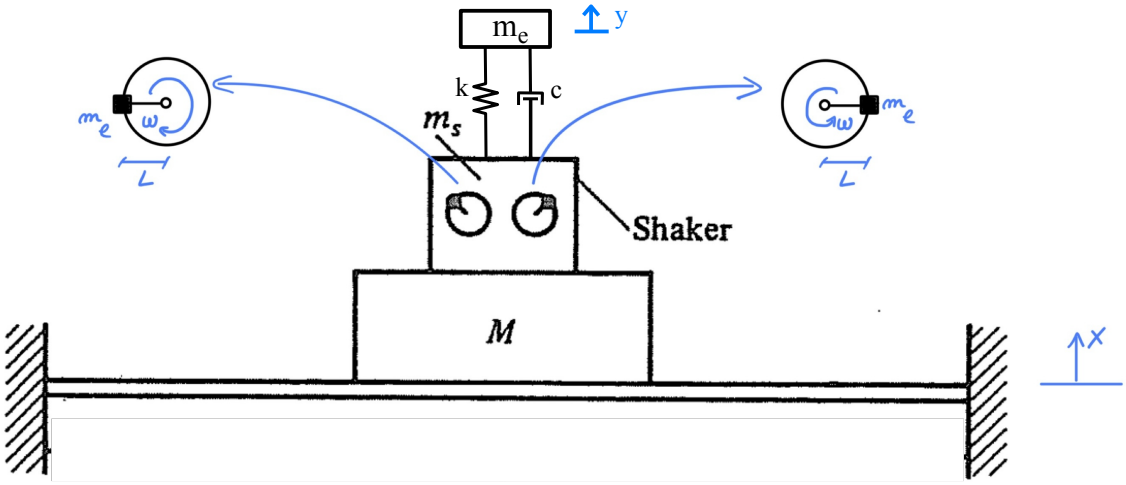

Figure 1: TMD on shaker

Isolation

We are interested in designing mounts for an electric engine that will isolate the vibrations between the engine and the chassis of a car. For an engine idle speed r expressed in rpm and a mass m, we ask you the following questions:

1. What is the equivalent simplified mass-spring system and applied force ?
2. What are the main frequencies of the forces applied by the engine when it is in idle mode ?
3. What is the range of values of stiffness of the mounts which ensures that you have a reduction of the forces transmitted to the car body at idle speed, compared to the situation where the engine would be rigidly attached.
4. In this range, which value of stiffness would be realistic and why ? What are the limitations ?
5. Explain what will happen when the engine is changing its rotation speed. Do you need to have damping in the mounts ? Why ?

Additional details for the exercise:

- After giving the analytical answers to the questions, you can use the following numerical values:
  - $r = 2000rpm$
  - $m = 150kg$