

**Faculty of Maritime Engineering and Marine Sciences**

**Mechanical Vibrations**

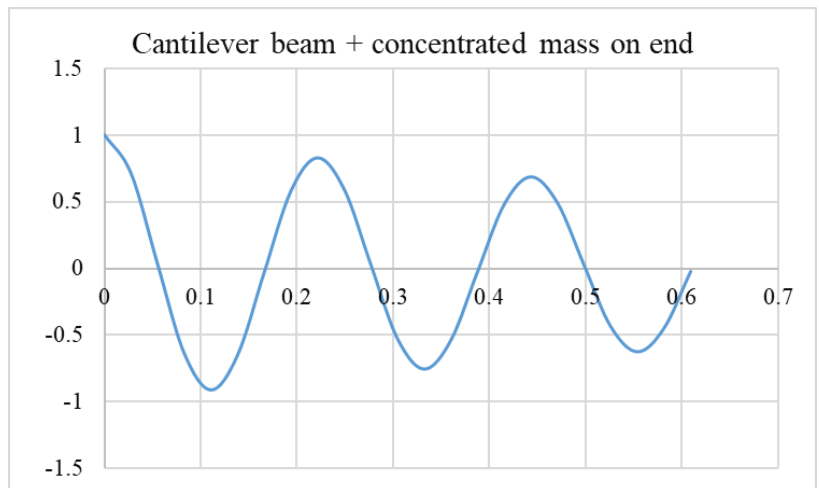
**First Evaluation – Oscillation 1 dof**

**November 24<sup>th</sup>, 2023**

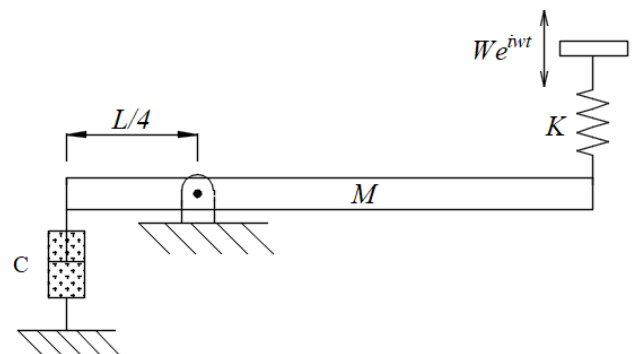
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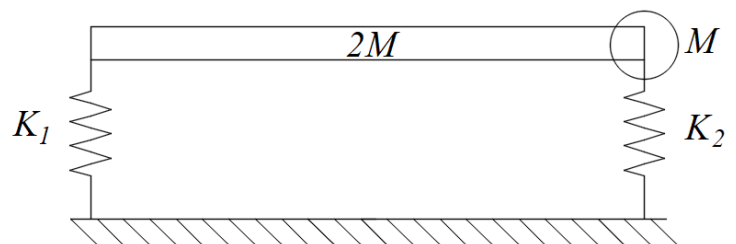
1.- A 40 cm long cantilever beam is to be modeled as a 1-dof system, and an experiment is developed to determine the effective stiffness and the damping coefficient of the system. When a 5 kg (much larger than the beam mass) is installed on the end, the following record of the tip displacement is obtained when the beam is deformed 1 mm and then released for free oscillation. (30)



2.- Calculate the maximum angle of oscillation of a rigid steel bar ( $A_{sect}$ : 10.7 cm<sup>2</sup>) which is pinned at  $L/4$  from its left end. On the right end a spring is installed, whose upper end supports a harmonic vertical motion  $w(t)$ . On the left end, a viscous damper is installed. Consider the following characteristics:  $L$ : 1.2 m,  $K$ : 200 kN/m,  $C$ : 400 kg<sub>m</sub>/sec, and  $M$ : 10 kg<sub>m</sub>. The motion of the top end has the following parameters: amplitude: 1 cm, and frequency: 350 rad/sec. (45)



3.- A system composed by a rigid bar with mass  $2M$  and length  $L$ , is supported by two springs located on its ends, with stiffnesses  $K_1$  and  $K_2$ . At the right end of the bar there is a concentrated mass  $M$  as shown in the figure. Deduce motion equations for the system, as it oscillates in the plane of the figure, and express it in matrix notation as function of the parameters shown in the figure. (25)



jml/2023

I certify that during this exam I have complied with the Code of Ethics of ESPOL.  
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