BMM3553 Mechanical Vibrations

Assignment 2
(Two Degree of Freedom)

by

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Question 1

An automobile simulation rig is assumed to be an undamped two-degree-of-freedom system as shown in **Figure Q1** where the motion is only in the plane of the paper, and,

Spring stiffnesses, k_1= 400N/m ; k_2= 500N/m
Automobile mass, m = 27kg
l_1= 10m and l_2=8m
Moment of inertia about G, I_G = 708 kgm^2

- Show that the equations of motion are given by

$$m\ddot{x} + (k_1 + k_2)x - (k_1\ell_1 - k_2\ell_2)\theta = 0$$
$$-(k_1\ell_1 - k_2\ell_2)x + I_G\ddot{\theta} + (k_1\ell_1^2 + k_2\ell_2^2)\theta = 0$$

(12 Marks)

- Show the system is uncoupled and hence determine the natural frequencies and mode shapes of the system.

(13 Marks)

Question 1

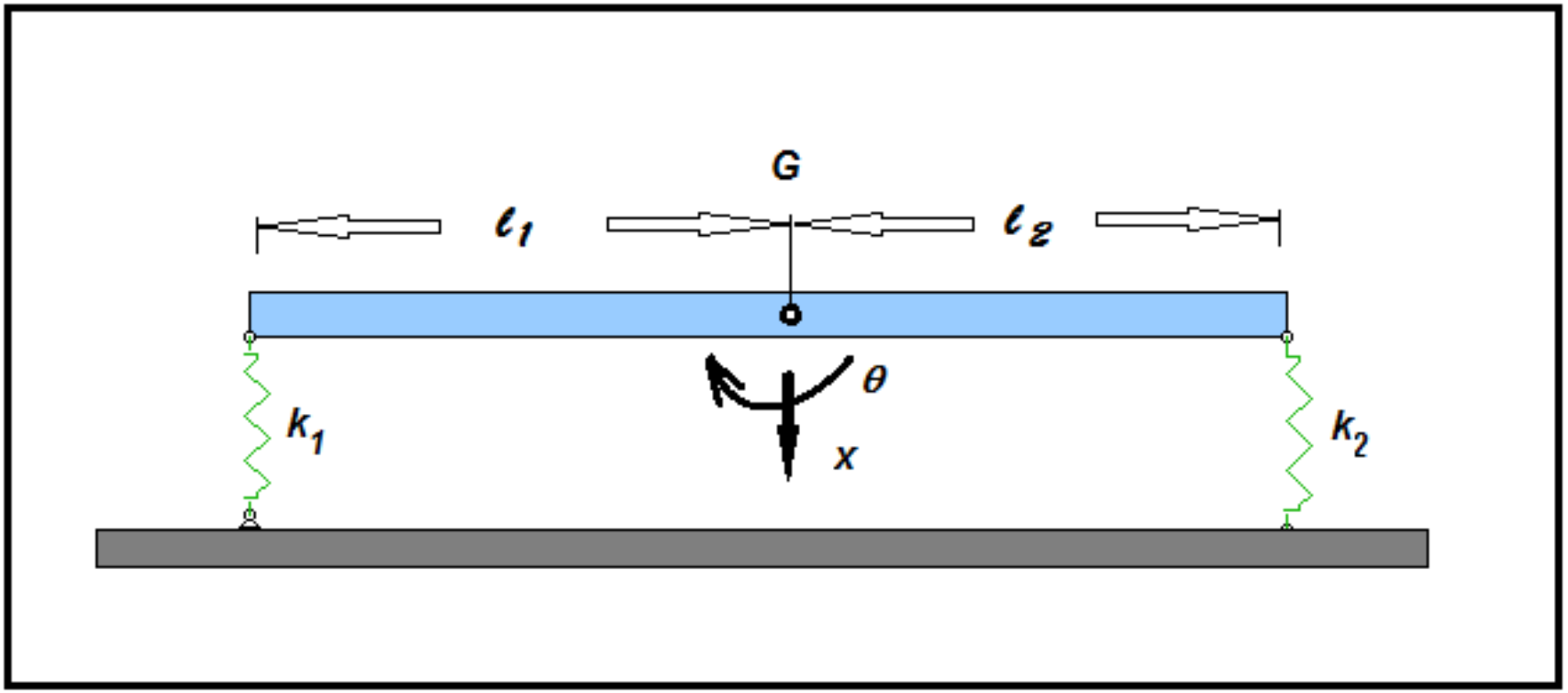

Figure Q1

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