MEEM 3700
Mechanical Vibrations

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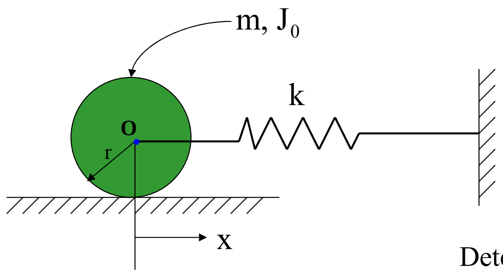
SDOF Systems: NO Damping

Problem 1



Determine ω_n by both Newton's method & Energy approach.

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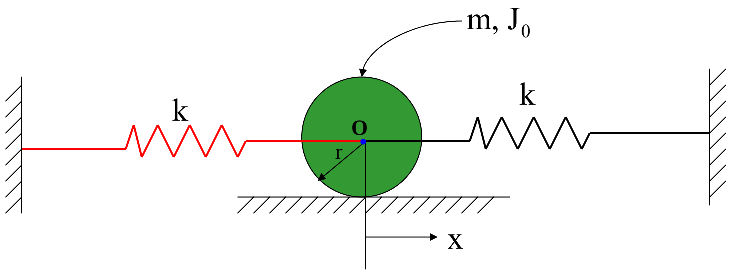
Problem 2



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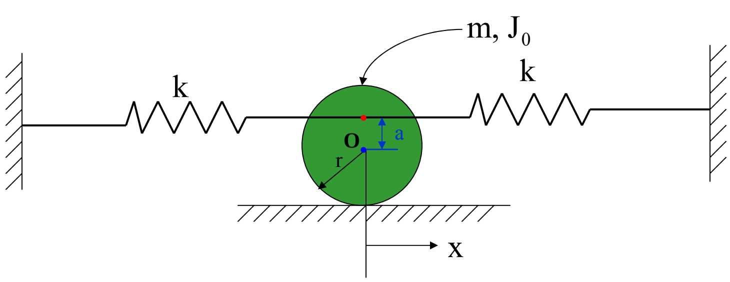
Problem 3



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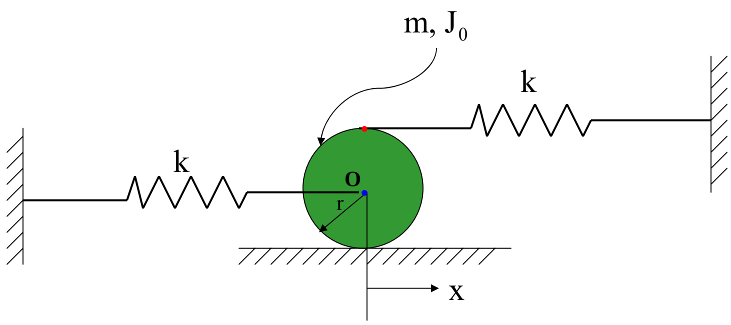
Problem 4



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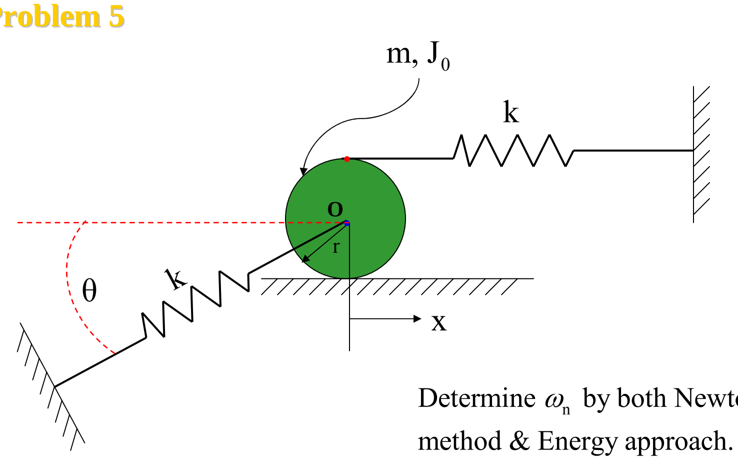
Problem 5



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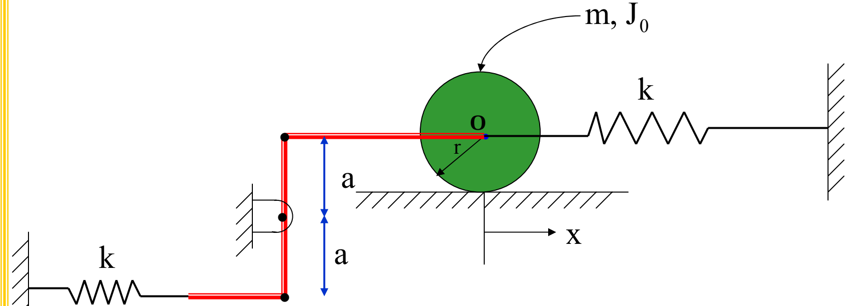
Problem 6



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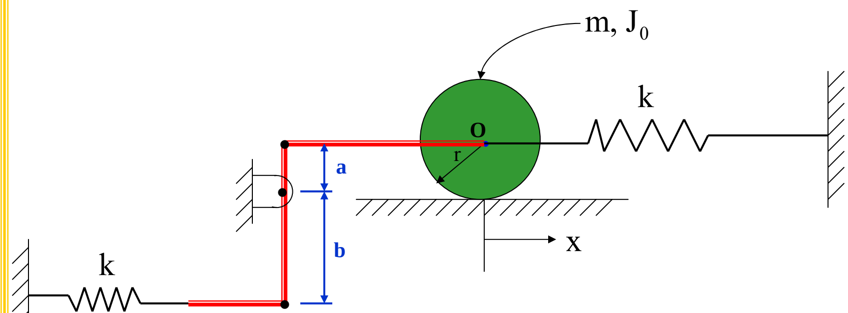
Problem 7



Determine ω_n by both Newton's method & Energy approach.

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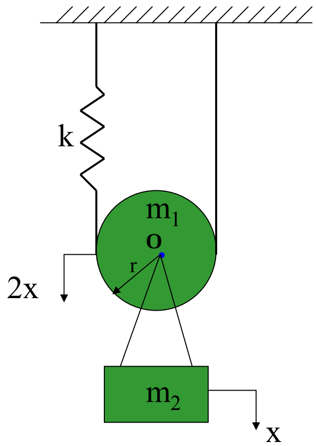
Problem 9



Determine ω_n by both Newton's method & Energy approach.

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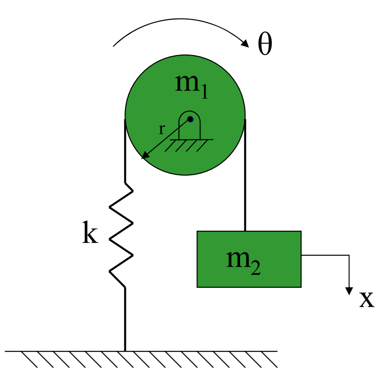
Problem 10



Determine ω_n by both Newton's method & Energy approach.

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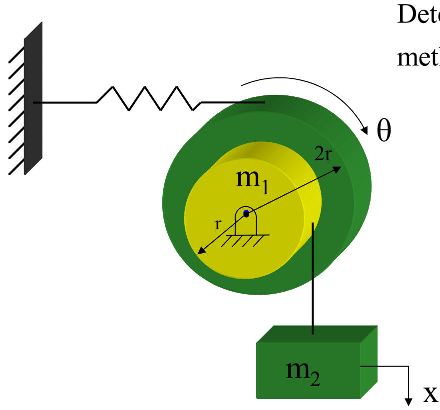
Problem 11

Determine ω_n by both Newton's method & Energy approach.



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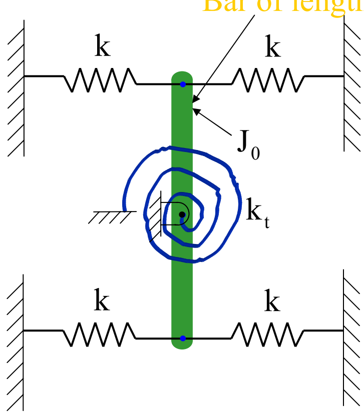
Problem 12

Bar of length 2l pivoted in the middle



Determine ω_n by both Newton's method & Energy approach.

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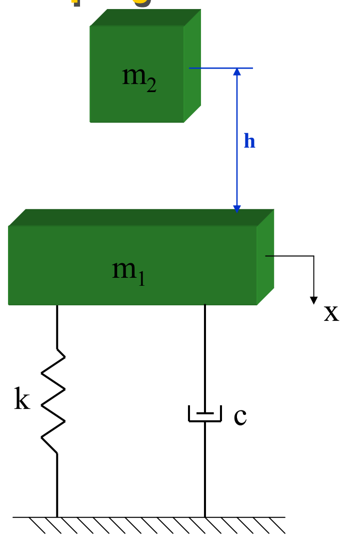
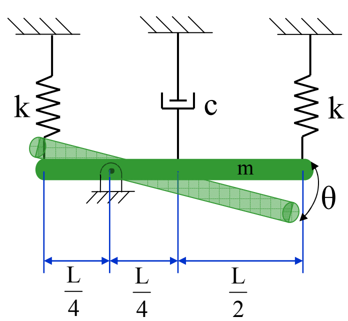
Problem 13

A mass is being dropped onto a SDOF system. Find x(t) after m_2 hits m_1.



SDOF Systems: With Damping

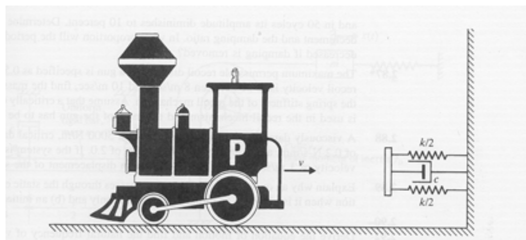
Problem 14



Determine ω_n by both Newton's method & Energy approach.

SDOF Systems: With Damping

Problem 15



A locomotive car of mass 2000 kg traveling at a velocity υ = 10 m/sec is stopped at the end of tracks by a spring-damper system, as shown in the figure. If the stiffness of the spring is k = 40 N/mm and the damping constant is c = 2 N-s/mm, determine:

a) the maximum displacement of the car after engaging the springs and damper
b) the time taken to reach the maximum displacement

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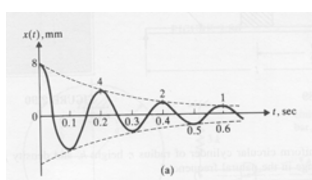
Problem 16



The free vibration response of an electric motor of weight 500 N mounted on a foundation is shown in figure. Identify the following:

i) the nature of damping provided by the foundation
ii) the spring constant and damping coefficient of the foundation
iii) the undamped and damped natural frequencies of the electric motor

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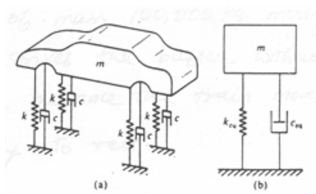
Problem 17



An automobile of mass = 1500 kg is supported on four shock absorbers (dampers) and four springs, each with stiffness of 70,000 N/m.

a) Find the damping constant of each of the four shock absorbers necessary to achieve critical damping

b) If the car is initially at rest and given an initial velocity of 2 m/sec, what would be the maximum displacement of the car body using the shock absorbers found in part (a)

Assume that the car moves only in the vertical direction and can be modeled as a SDOFsystem.

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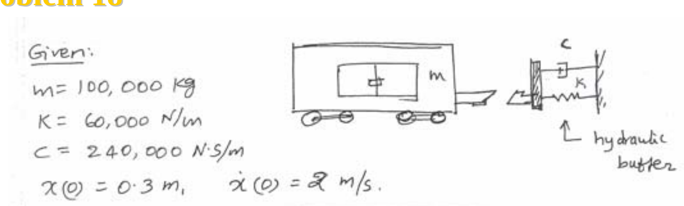
SDOF Systems: With Damping

Problem 18



A hydraulic buffer consists of an internal spring of stiffness 60,000 N/m in parallel with a viscous damper having c = 240,000 N-s/m. The spring is initially compressed an amount 0.3 m. If a train of mass 100,000 kg moving at velocity of 2 m/s strikes the buffer without rebound, determine the distance the train moves before coming momentarily to rest.