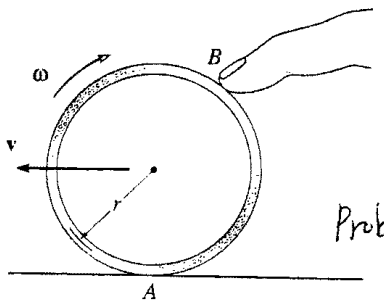
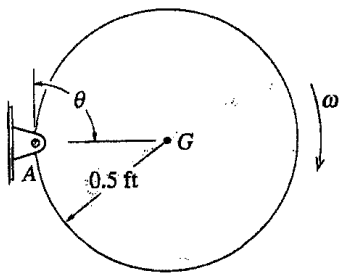
※ 考生請注意 本試題 ☑可 ☐不可 使用計算機

Problem 1 By pressing down with the finger at B, a thin ring having a mass m is given an initial velocity v and a backspin ω when the finger is released. If the coefficient of kinetic friction between the table and the ring is k, determine the distance the ring travels forward before backspinning stops. (25%)



Prob. 1

Problem 2 The 20-kg disk is rotating about pin A in the vertical plane with an angular velocity ω = 4 rad/s when θ = 0° Determine its angular velocity at the instant θ = 90° Also compute the vertical component of reaction at A at this instant. (25%)



Prob. 2

(背面仍有題目,請繼續作答)

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Problem 3: (25 Points)

A. Consider a particle moves in one-dimension. If its **velocity-displacement** relation is known and can be plotted as a graph, please tell us how to calculate the acceleration of the particle. (5 Pts)

B. As shown in Figure P3, a 250-Kg crate B is suspended from a cable attached to a 20-Kg trolley A which rides on an inclined I-beam as shown. Knowing that at the instant shown the trolley has an acceleration of $0.4 m/s^2$ up to the right. Please determine **the acceleration of B relative to A** and **the tension in cable CD**. (20 Pts)

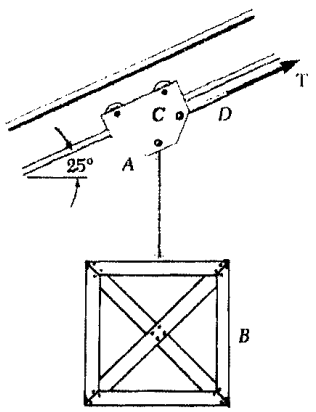

Figure P3

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Problem 4 (25 Points)

(a) Consider the forced response of a system shown in Figure P4-1 and Figure P4-2. The force input is a sine wave with a forcing amplitude =1N, please identify the necessary system parameters (i.e., system mass, damping coefficient, spring constant, and the frequency of the force input.) (10 Pts)

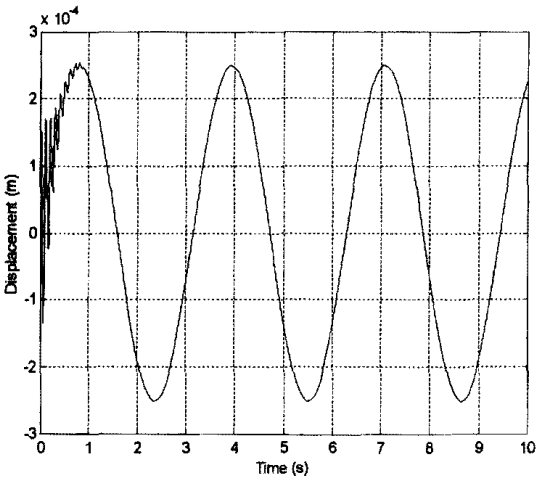

Figure P4-1

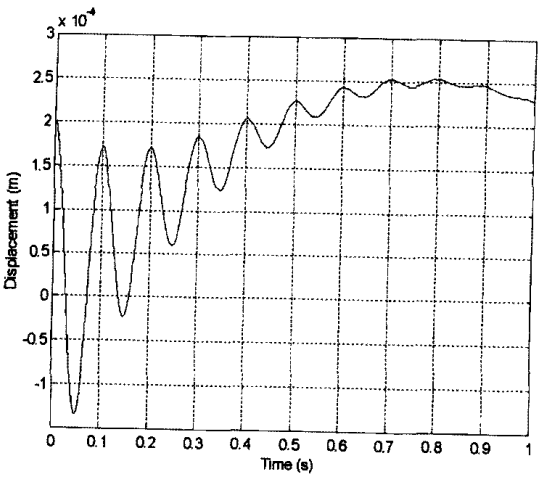

Figure P4-2

(b) A cylinder of mass m and mass moment of inertia J_0 is free to roll without slipping, but is restrained by the spring k, as shown in Figure P4-3 Please determine the natural frequency of oscillation. **(15 Pts)**

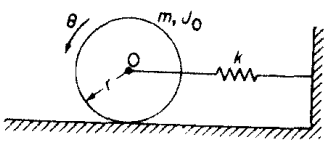

Figure P4-3