Issue: (Wed) 09/ 11/ 2024
Due: (Fri) 09/27/ 2024 18:00

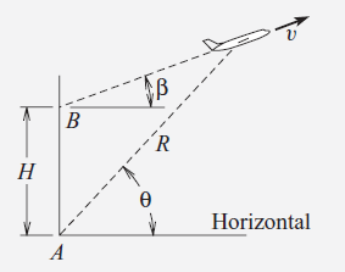
分析動力學作業 #0 Total 100 Points

Review of Undergraduate Dynamics

本作業的目的是透過一系列大學部動力學題目，讓各位同學盡快 catch 其基本概念. 你或許可以在一些動力學課本找到類似的題目，歡迎參考，但要讀過，不要一字不漏謄寫下來. 本作業的目的是讓各位有動機去回顧本課程所需之背景材料.

遲交不予計分

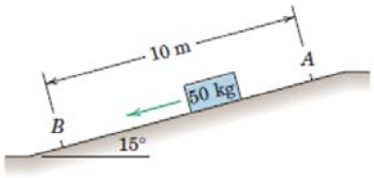
Problem 1. Dynamics in Curvilinear Coordinate



An airplane climbs at a constant speed v and constant climb angle β. The airplane is being tracked by a radar station at point A on the ground. Determine the radial velocity $\dot{R}$ and the angular velocity $\dot{\theta}$ as functions of the tracking angle θ.

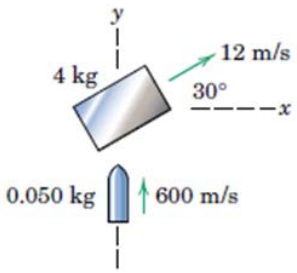
Problem 2. Work and Energy of Particles

Calculatge the velocity v of the 50-kg crate when it reaches the bottom of the chute at B if it is given an initial velocity of 4m/s down the chute at A. The coefficient of kinetic friction is 0.30.



Problem 3. Principle of Impulse and Momentum

The 50-grams bullet travelling at 600 m/s strikes the 4-kg block centrally and is embadded within it. If the block slides on a smooth horizontal plane with a velocity of 12 m/s in the direction shown prior to impact, determine the velocity v_2 of the block and the embedded bullet immediately after impact.



Problem 4. Kinematics of Planar Rigid Bodies

A pendulum consisting of a rigid, massless rod with two masses m_1 and m_2 is suspended from a frictionless pivot A. If the system is displaced from the equilibrium position and released, then it will oscillate under the action of gravity in the indicated plane. Determine the equations of motion for the pendulum.

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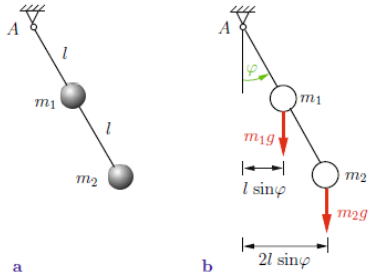
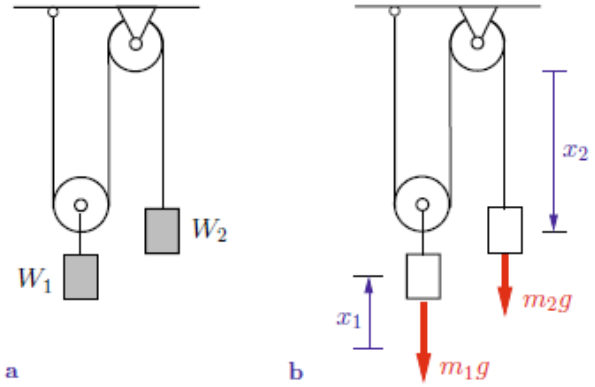


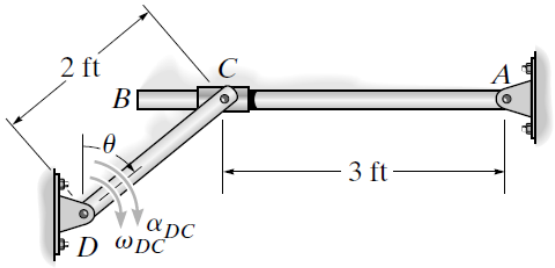
Problem 5. Work and Energy of Planar Rigid Bodies

The system shown below is released from rest. Assuming that the rope is massless and inextensible, and that the pulleys are massless, find the velocity of mass m1 as a function of its displacement.



Problem 6. Rotating Frames

At the instant θ=45°, link *DC* has an angular velocity of ω_{DC} = 4 rad/s and an angular acceleration of α_{DC} = 2 rad/s^2. Determine the angular velocity and angular acceleration of rod *AB* at this instant. The collar at *C* is pin connected to *DC* and slides freely along *AB*.



Problem 7. Dynamics of Planar Rigid Bodies

The arm 0*A* and the disk in Fig. 3.10a rotate with constant angular velocities $\omega 1$ and $\omega 2$, respectively. Determine the velocity and acceleration of point *P* as functions of the angle ψ.

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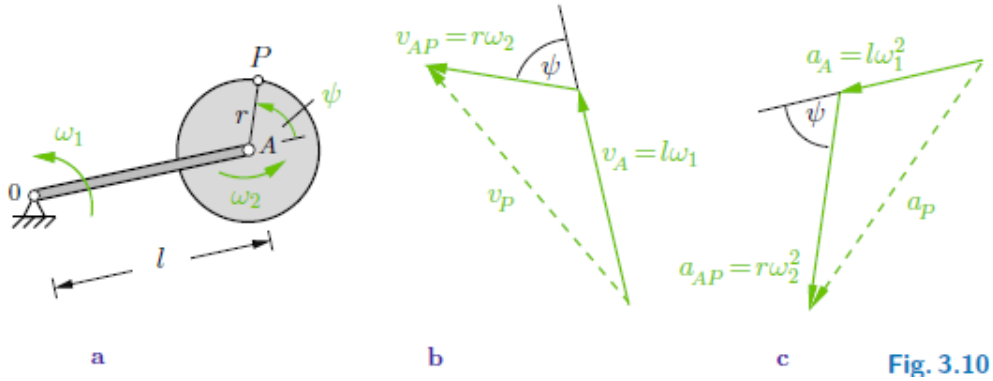
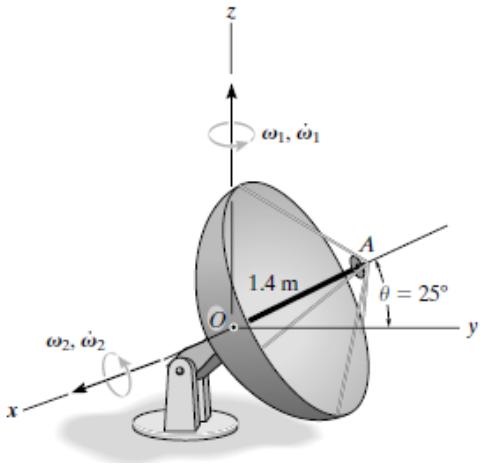


Fig. 3.10

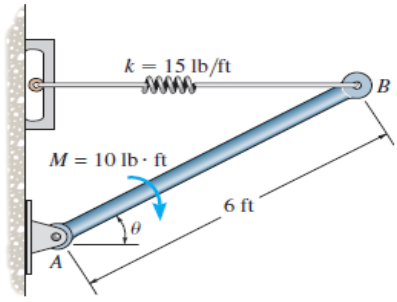
Problem 8. Simple 3D Kinematics

At a given instant, the satellite dish has an angular motion ω_1= 6 rad/s and $\dot{\omega}_1$ = 3 rad/s^2 about the z axis. At this same instant θ=25°, the angular motion ω1 about the x axis is ω_2= 2 rad/s and $\dot{\omega}_2$ = 1.5 rad/s^2, and . Determine the velocity and acceleration of the signal horn A at this instant.



Problem 9. Principle of Virtual Work

Determine the force developed in the spring required to keep the 10 lb uniform rod *AB* in equilibrium when θ= 35°.



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Problem 10. Mechanical Vibrations

A rod (length l, with negligible mass) carries a mass m at its upper end. It is supported by a linear spring (spring constant k). Describe the motion of the rod if it is displaced from its vertical position (small displacement) and then released (no initial velocity).