Palestine Technical University- Kadoorie (PTUK)

Mechanical Engineering Department

12210244: Dynamics

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This is an explanation of the Dynamics course

offered at Palestine Technical University - Kadoorie

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Textbook:

Engineering Mechanics: Dynamics, 7th Edition

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Chapter Six: Plane Kinetics of Rigid Bodies

Section Five: General Plane Motion

6 Plane Kinetics of Rigid Bodies

6.5 General Plane Motion

$$\sum \vec{F} = m\vec{a}_G$$

$$\sum \vec{M}_G = I_G\vec{\alpha}$$

$$\sum \vec{M}_O = I_O\vec{\alpha}$$

$$I_O = I_G + md^2$$

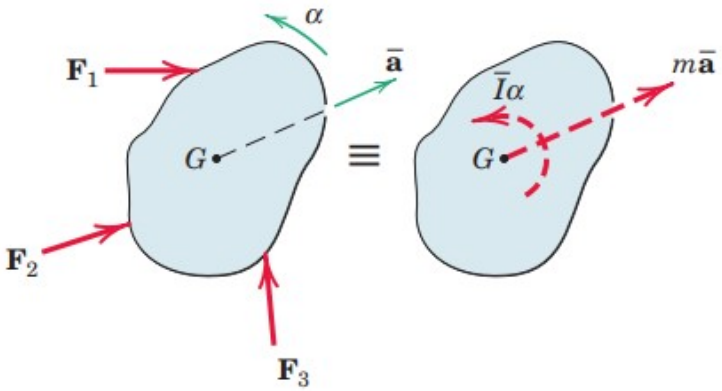


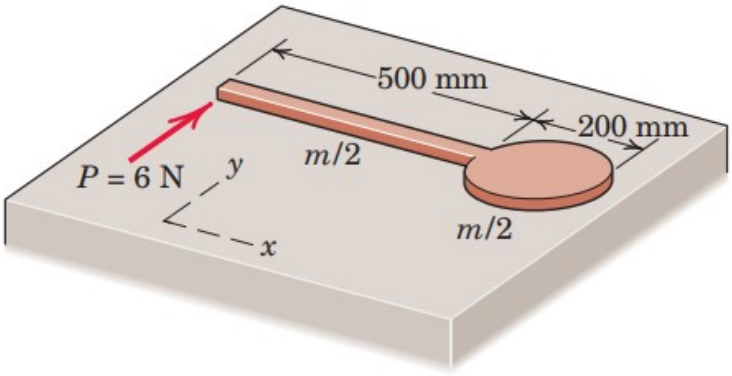
Figure 6/4

End of Section 6.5

Example 1:

The body consists of a uniform slender bar and a uniform disk, each of mass m. It rests on a smooth surface. Determine the angular acceleration and the acceleration of the mass center of the body when the force $P = 6\ N$ is applied as shown. The value of the mass m of the entire body is $1.2\ kg$.

ans. $a_G = 5\hat{j}\ m/sec^2$ $\alpha = 48.8\ rad/sec^2\ CW$

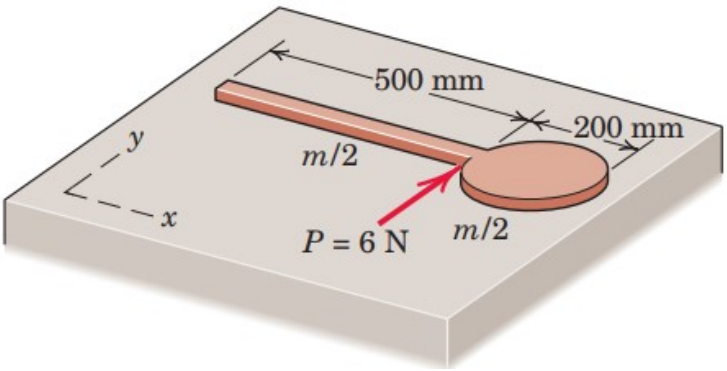


Ans.

Example 2:

The body consists of a uniform slender bar and a uniform disk, each of mass m. It rests on a smooth surface. Determine the angular acceleration and the acceleration of the mass center of the body when the force $P = 6\ N$ is applied as shown. The value of the mass m of the entire body is 1.2 kg.

ans. $a_G = 5\hat{j}\ m/sec^2$ $\alpha = 8.61\ rad/sec^2\ CCW$

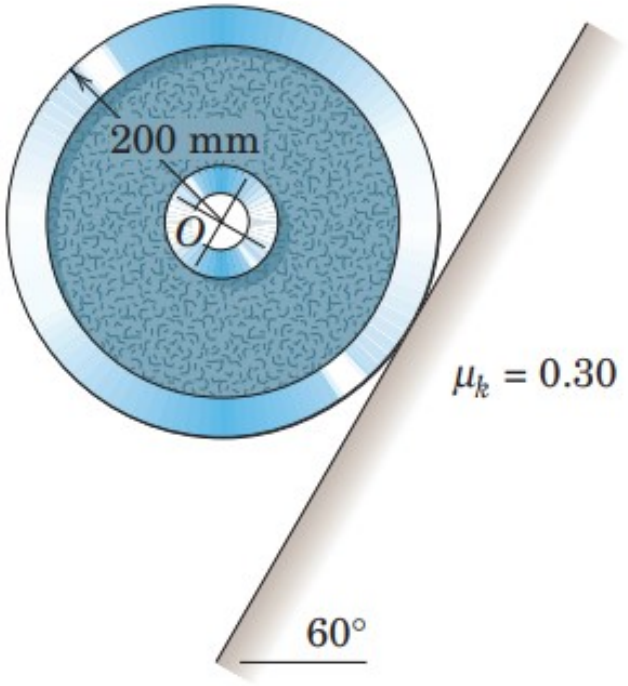


Ans.

Example 3:

The 10-kg wheel with a radius of gyration of 180 mm about its center O is released from rest on the 60° incline and slips as it rolls. If the coefficient of kinetic friction is $\mu_k = 0.3$, calculate the acceleration a_O of the center O of the wheel and its angular acceleration α.

ans. $a_G = 7.02\ m/sec^2\ downward$ $\alpha = 9.08\ rad/sec^2\ CCW$

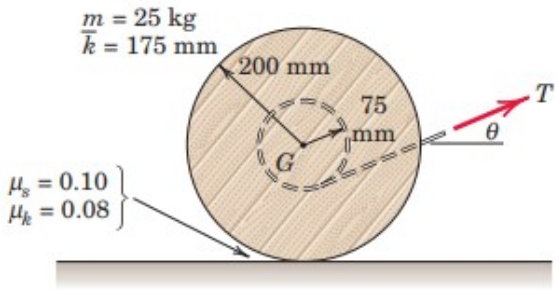


Ans.

Example 4:

The circular disk of 200 mm radius has a mass of 25 kg with centroidal radius of gyration $k = 175\ mm$ and has a concentric circular groove of 75 mm radius cut into it. A steady force T is applied at an angle θ to a cord wrapped around the groove as shown. If $T = 50\ N$, $\theta = 30°$ and $\mu_K = 0.08$, determine the angular acceleration of the disk α, the acceleration a of its mass center G, and the friction force F which the surface exerts on the disk

ans. $a_G = 1.027\ m/sec^2\ right$ $\alpha = 0.295\ rad/sec^2\ CCW$ $F = 19.38\ N$



Ans.