Module 5 - Rotation Systems

ME3050 - Dynamics Modeling and Controls

Mechanical Engineering

Tennessee Technological University

Topic 1 - The Dynamics of Rotation

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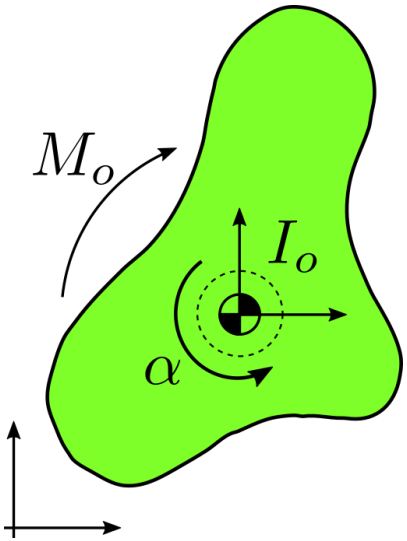
- Newton's Second in Rotation
- Fixed Axis Rotation
- Instantaneous Center of Rotation
- Engineering Applications

Newton's Second in Rotation

Newton's Second Law equates the mass moment of inertia to the angular acceleration of a rigid body.

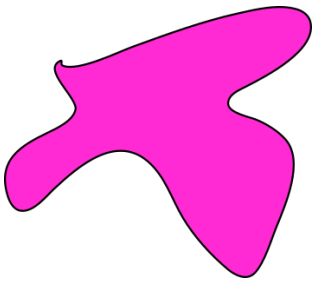


$$\Sigma M_o = I_o \alpha = I_o \dot{\omega}$$

Images: T.Hill

Fixed Axis Rotation

This expression is only valid for a system constrained to *rotation about a fixed axis*.

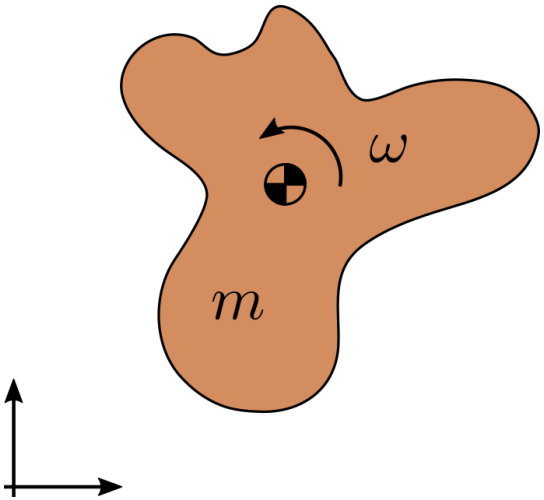


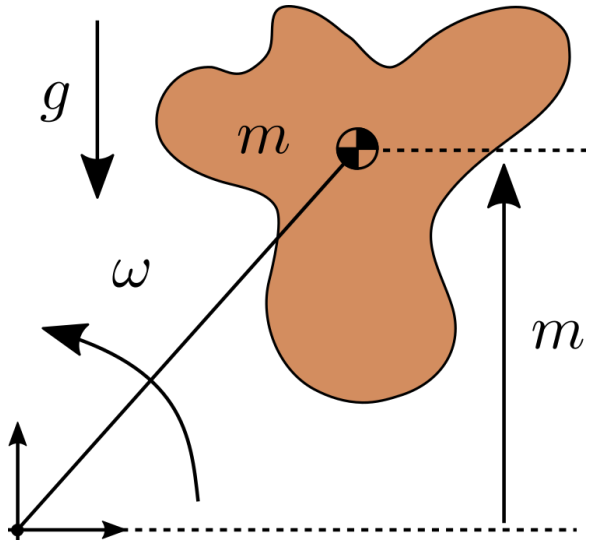
$$\Sigma M_o = I_o \alpha = I_o \dot{\omega}$$

Images: T.Hill

Instantaneous Center of Rotation

As you know there is a kinetic energy associated with the rotating mass. If the rotation is in the vertical plane there is a gravitational potential.





$KE = T = \frac{1}{2} I_o \omega^2$

$PE = V = mgy$

Engineering Applications

Rotating systems are used in machines and engineering systems of all types.

- IC engines
- Electric Motors
- Wheels, Gears, Transmissions
- ...