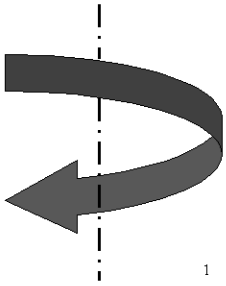
Chapter 11

Kinematics:
Angular Motion



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Objectives

- Angular Displacement (rads)
- Angular Velocity (rpm, or rads/s)
- Angular Acceleration (rads/s^2)
- All based on equations similar to Rectilinear Motion

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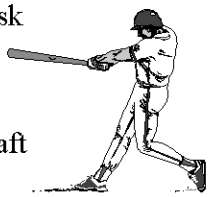
Angular Motion

- Any body that rotates about a point undergoes angular motion
  - –Rotating a pulley or disk
  - –Swinging a bat
  - –Spinning a propeller
  - –Rotation of a motor shaft



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Angular Displacement

- A lever rotates one quarter of a turn – angular displacement is 90 degrees
- Measured in radians
  - –There are 2π radians in 360°
- 90° = 2π /4 = 1.57 rad
- Note calculators degrees vs radians

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Angular Velocity

- Rate of change of angular disp.
- ω = Δθ/Δt
- Omega = rad/s, rpm or rev/min
- Rarely determined in degrees/s
- 1000 revs in 600 sec = 100 rpm

$$100\ \frac{rev}{\min} x \frac{1\min}{60\ s} x \frac{2\pi\ \ rad}{1\ rev} = 10.47\ rad/s$$

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Angular Acceleration

- Rate of change of angular velocity is the letter alpha (α)
- Acceleration is in rad/s^2

$$\alpha = \frac{\Delta\omega}{\Delta t} = \frac{\omega_2 - \omega_1}{t_2 - t_1}$$

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Angular motion with uniform acceleration

- Use the same equations as we used in rectilinear motion
- Substitute θ, ω, α for *s, v, a*
- Remember that these equations are based on uniform acceleration

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Equations

$$s = s_0 + v_0 t + \frac{1}{2} a t^2 \qquad \theta = \theta_0 + \omega_0 t + \frac{1}{2} \alpha t^2$$

$$v = v_0 + at \qquad \omega = \omega_0 + \alpha t$$

$$v^2 = v_0^2 + 2as \qquad \omega^2 = \omega_0^2 + 2\alpha\theta$$

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Units

- When determining angular motion, be sure to change everything to radians and seconds.

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Week 4 Homework

- Chapter 11
  - –7, 8, 12, 15, 20, 21 & 24
  - –Read Section 11-6 &11-7
  - –Quiz No. 1 next week over Chapters 9 & 10

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