MACHINE THEORY
Bachelor in Mechanical Engineering

FLYWHEELS

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DEFINITION

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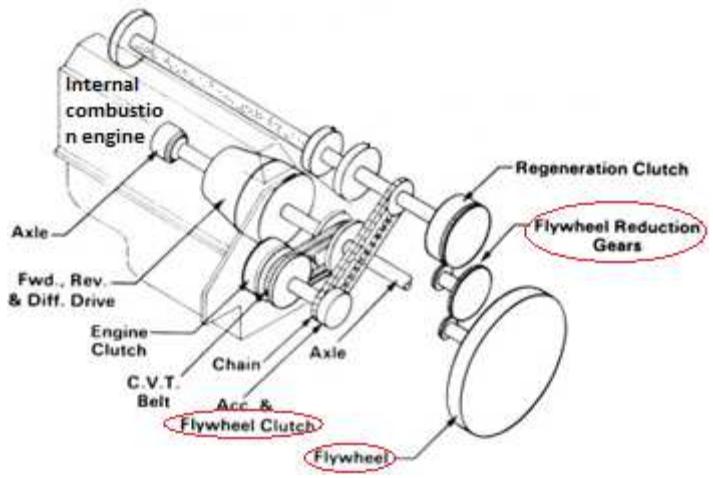
- A flywheel is a mechanical device with significant moment of Inertia which is used as a storage for kinematic energy.
  - Storages energy when the supply is more than necessary.
  - Releases energy when the required energy is higher than the supply.

- Flywheels rotate about one axis.



Source: Wikipedia

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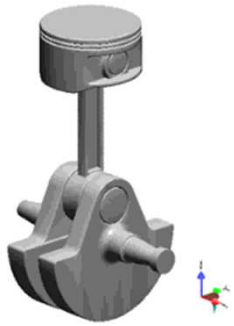
APPLICATIONS

- **They are used mainly in:**
- **Electric generators**
- Consider a four-stroke-cycle internal-combustion engine. The torque delivered varies considerably due to the fact that there is one power stroke only once every two revolutions. A flywheel assures uniform velocity and therefore uniform torque to the generator.



- **Mechanisms: To overcome death points.**

- **Saving Energy :**
- Imagine a punching process which needs a big amount of power. Some of this power can be supplied by a flywheel instead of a motor.

- **F1 KERS SYSTEM**

http://www.youtube.com/watch?v=xAvexjr2ax0

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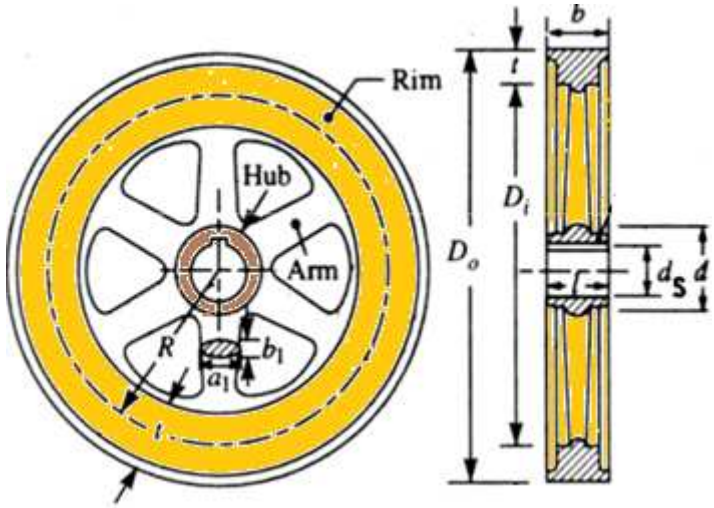
Terms and definitions



- I_{disk}
- Kinetic energy storage
- We can express energy in function of angular or in function of tangential velocity of any point in the rim.

$E=1/2\ I\omega^2$ $E=1/2\ MV^2$

Terms and definitions

Coefficient of fluctuation

$$C = \frac{\omega_1 - \omega_2}{\omega}$$

$$C = \frac{V_1 - V_2}{V}$$

ω_1 – max angular speed

ω_2 – min angular speed

ω – average angular speed

V_1 – max speed at the rim

V_2 – min speed at the rim

V – average speed at the rim

Satisfactory values:

- 0.01 - 0.05 (precision machinery)
- Up to 0.2 (e.g punch presses)

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Terms and definitions

- The average velocity

$$V = \frac{V_1 - V_2}{2}$$

- Multiplying both equations

$$E_{k1} = \frac{1}{2} M V_1^2 \qquad E_{k2} = \frac{1}{2} M V_2^2$$

- The KEnergy

$$\Delta E = \frac{1}{2} M \left(V_1^2 - V_2^2 \right)$$

- We can say:

$$CV = V_1 - V_2$$

$$2CV^2 = (V_1^2 - V_2^2)$$

$$E = \frac{1}{2} M (V_1^2 - V_2^2)$$

➔ Coefficient of fluctuation (C)

$$\Delta E = MCV^2$$