

Angular Kinetic Energy

Alejandro A. Torassa

Creative Commons Attribution 3.0 License
(2014) Buenos Aires, Argentina
atorassa@gmail.com

Abstract

This paper presents an alternative equation to calculate the angular kinetic energy of a particle which describes a circular motion.

Angular Kinetic Energy

The angular kinetic energy of a particle A of mass m_a , is given by:

$$\frac{1}{2} m_a (\mathbf{r} \times \mathbf{v}_a)^2$$

where \mathbf{r} is a position vector which is constant in magnitude and direction, and \mathbf{v}_a is the velocity of particle A.

If particle A has an angular velocity $\boldsymbol{\omega}_a$ and since $\mathbf{v}_a = \boldsymbol{\omega}_a \times \mathbf{r}_a$, then we have:

$$\frac{1}{2} m_a (\mathbf{r} \times (\boldsymbol{\omega}_a \times \mathbf{r}_a))^2$$

If the position vector \mathbf{r} is parallel to the angular velocity $\boldsymbol{\omega}_a$, it follows that:

$$\frac{1}{2} m_a \mathbf{r}_a^2 (\mathbf{r} \cdot \boldsymbol{\omega}_a)^2$$

Finally, since $m_a \mathbf{r}_a^2$ is the moment of inertia I_a of particle A, we obtain:

$$\frac{1}{2} I_a (\mathbf{r} \cdot \boldsymbol{\omega}_a)^2$$