Principle of Conservation

Alejandro A. Torassa

(2013) Buenos Aires, Argentina
atorassa@gmail.com

Abstract

In classical mechanics, this paper presents a new principle of conservation for frontal elastic collisions, which can be applied in any inertial reference frame.

Principle of Conservation

In an isolated system of N particles, the new principle of conservation for frontal elastic collisions, is given by:

$$\sum_{i=1}^{N} {}^{1}\!/_{2}\, m_i \, (\mathbf{r}_i \times \mathbf{v}_i)^2 = constant$$

where m_i is the mass of the i-th particle, $\mathbf{r}_i$ is the position of the i-th particle, and $\mathbf{v}_i$ is the velocity of the i-th particle.

Appendix

Angular Work

The angular work W_a done by a constant moment $\mathbf{M}_a$ acting on a particle A, is given by:

$$W_a = \mathbf{M}_a \cdot (\mathbf{r}_a \times \mathbf{d}_a)$$

where $\mathbf{r}_a$ is the position of particle A, $\mathbf{d}_a$ is the displacement vector of particle A, and $\mathbf{F}_a$ is the constant force acting on particle A $[\,\mathbf{M}_a = (\mathbf{r}_a \times \mathbf{F}_a)\,]$

Angular Kinetic Energy

The angular work done by the net moment acting on a particle A is equal to the variation of the angular kinetic energy of particle A.

$$W_a = \Delta\, {}^1\!/_2\, m_a\, (\mathbf{r}_a \times \mathbf{v}_a)^2$$

Therefore, if the net moment acting on particle A does no angular work then the angular kinetic energy of particle A remains constant.