

19.5: Angular Impulse and Change in Angular Momentum

If there is a total applied torque $\vec{\tau}_S$ about a point S over an interval of time $\Delta t = t_f - t_i$, then the torque applies an angular impulse about a point S , given by

$$\vec{\mathbf{J}}_S = \int_{t_i}^{t_f} \vec{\tau}_S dt$$

Because $\vec{\tau}_S = d\vec{\mathbf{L}}_S^{\text{total}}/dt$ the angular impulse about S is equal to the change in angular momentum about S ,

$$\vec{\mathbf{J}}_S = \int_{t_i}^{t_f} \vec{\tau}_S dt = \int_{t_i}^{t_f} \frac{d\vec{\mathbf{L}}_S}{dt} dt = \Delta \vec{\mathbf{L}}_S = \vec{\mathbf{L}}_{S,f} - \vec{\mathbf{L}}_{S,i}$$

This result is the rotational analog to linear impulse, which is equal to the change in momentum,

$$\vec{\mathbf{I}} = \int_{t_i}^{t_f} \vec{\mathbf{F}} dt = \int_{t_i}^{t_f} \frac{d\vec{\mathbf{p}}}{dt} dt = \Delta \vec{\mathbf{p}} = \vec{\mathbf{p}}_f - \vec{\mathbf{p}}_i$$

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