

5.6: Angular Momentum

In analogy with the definition of torque, $\boldsymbol{\tau} = \mathbf{r} \times \mathbf{F}$ as the rotational counterpart of the force, we define the **angular momentum** \mathbf{L} as the rotational counterpart of momentum:

$$\mathbf{L} = \mathbf{r} \times \mathbf{p} \quad (5.6.1)$$

For a rigid body rotating around an axis of symmetry, the angular momentum is given by

$$\mathbf{L} = I\boldsymbol{\omega} \quad (5.6.2)$$

where I is the **moment of inertia** of the body with respect to the symmetry axis around which it rotates. Equation 5.6.2 also holds for a collection of particles rotating about a symmetry axis through their center of mass, as readily follows from 5.4.2 and 5.6.1. However, it does not hold in general, as in general, \mathbf{L} does not have to be parallel to $\boldsymbol{\omega}$. For the general case, we need to consider a moment of inertia tensor \mathbf{I} (represented as a 3×3 matrix) and write $\mathbf{L} = \mathbf{I} \cdot \boldsymbol{\omega}$. We'll consider this case in more detail in Section 7.3.

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