

TOOL: The following equations from physics describe the relationship between basic quantities.

VELOCITY:

$$\vec{s} = \frac{d\vec{l}}{dt} \text{ (linear velocity)} \qquad \omega = \frac{d\theta}{dt} \text{ (angular velocity)}$$

INERTIA:

$$J = \int_V \rho r^2 dV \text{ (rotating around axis)}$$

FORCE:

$$\vec{F} = q\vec{E} + q\vec{s} \times \vec{B} \qquad F = \frac{\tau}{r} \qquad \vec{F} = m \frac{d^2\vec{l}}{dt^2}$$

TORQUE:

$$\vec{\tau} = \vec{r} \times \vec{F} \qquad \tau = J \frac{d\omega}{dt}$$

POWER:

$$p = iv \qquad p = \tau\omega \qquad p = Fs$$

$$\frac{d}{dt} \left(\frac{1}{2} J\omega^2 \right) \qquad \frac{d}{dt} \left(\frac{1}{2} Li^2 \right) \qquad \frac{d}{dt} \left(\frac{1}{2} Cv^2 \right)$$

ENERGY:

$$w = \int p dt \qquad w = \int \vec{F} \circ d\vec{l} \qquad w = \int iv dt$$

$$w = \frac{1}{2} ms^2 \qquad w = \frac{1}{2} J\omega^2$$

$$w = \frac{1}{2} Li^2 \qquad w = \frac{1}{2} Cv^2$$