Dynamics Review - Topic 4

ME3050 - Dynamics Modeling and Controls

May 29, 2020

Topic 4 - Describing Motion

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- Degrees of Freedom

- Translation

- Rotation

Degrees of Freedom

The Degrees of Freedom is the number of independent motions that exist in a system.

OR

The Degrees of Freedom is the minimum number of coordinates required to completely describe motion or state of the system.

Translation

Translational motion is:

- motion along a straight line.
- rotation about a point really far away?

Position	$x(t)$
Velocity	$v_x(t) = \frac{dx(t)}{dt} = \dot{x}$
Acceleration	$a_x(t) = \frac{dv(t)}{dt} = \frac{d^2x(t)}{dt^2} = \ddot{x}$

Rotation

Rotational motion is:

- motion along a circular path about a fixed point or axis
- acceleration towards the center of rotation

Angular Position	$\theta_z(t)$
Angular Velocity	$\omega_z(t) = \frac{d\theta(t)}{dt} = \dot{\theta}$
Acceleration	$\alpha_z(t) = \frac{d\omega(t)}{dt} = \frac{d^2\theta(t)}{dt^2} = \ddot{\theta}$

Equations of Rotation

Youused these important relationships in your dynamics course.

$$\vec{v} = \vec{r} \times \vec{\omega}$$