7. Mind Map: Rotation & Angular Variables

Rotational Dynamics (Angular Variables)

Rotation Motion
- An object turning about an axis of rotation.
- Axis of Rotation: The fixed line about which the body rotates (e.g. z-axis)
- Pure Rotation: Every point on the body moves through the same angle in a given time (in a circle, centered on the axis of rotation)

Angular Position (Linear equivalent x)
- Definition: The *Angle* an imaginary line makes *relative to the positive x-axis* (imaginary line is made on the rigid body and perpendicular to the axis of rotation)
- 1 radian = 57.3° = 0.159 revolutions (rev)

Angular Displacement (Linear Equivalent: Change in x ($\Delta x = x_2 - x_1$))
- Definition: Change in angular position ($\Delta\theta = \theta_2 - \theta_1$)
- Linear Equivalent: Change in x ($\Delta x = x_2 - x_1$)

Angular Velocity (Linear equivalent: Velocity v)
- Definition: Rate of change of angular displacement
- Average Angular Velocity — $\omega_{avg} = (\theta_2 - \theta_1) / (t_2 - t_1)$
- Instantaneous Angular Velocity — $\omega = d\theta / dt$

Angular Acceleration (Linear equivalent: Acceleration a)
- Definition: Rate of change of angular velocity
- Average Angular Acceleration — $\alpha_{avg} = (\omega_2 - \omega_1) / (t_2 - t_1)$
- Instantaneous Angular Acceleration — $\alpha = d\omega / dt$

Vectors and Rotation
- Angular Quantities as Vectors: Determined by –ve sign if motion is clockwise and +ve if anti-clockwise
- Angular velocity (ω) and angular acceleration (α) are vectors. Angular displacement ($\Delta\theta$) is not a vector because it does not follow vector addition rules
- Right Hand Rule: Curl fingers in the direction of rotation then thumb points in direction of angular velocity vector