

Topic

Kinetics of a Particle: Force and Acceleration

Governing Equations and Assumptions

$$\left. \begin{aligned} \sum F_x &= ma_x \\ \sum F_y &= ma_y \\ \sum F_z &= ma_z \end{aligned} \right\} \text{Rectangular Coordinates}$$

$$\left. \begin{aligned} \sum F_t &= ma_t \\ \sum F_n &= ma_n \\ \sum F_b &= 0 \end{aligned} \right\} \text{Normal and Tangential Coordinates}$$

$$a_n = \frac{v^2}{\rho}, \rho = \frac{[1 + (\frac{dy}{dx})^2]^{3/2}}{|\frac{d^2y}{dx^2}|}, \quad a = \frac{dv}{dt}, \quad v = \frac{ds}{dt}, \quad a ds = v dv$$

Process

- ① Determine the Coordinate System
- ② Draw the Free Body Diagram (FBD) and the Kinetic Diagram
- ③ Apply $F=ma$
- ④ Apply Kinematics to solve for additional quantities (velocity, ...)