

Summary for Test 3: Kinetics

Newton

$$\hat{?} \bar{F} = m \bar{a}_G$$

$$\hat{?} \bar{M}_G = I_G \bar{a}$$

$$\hat{?} \bar{M}_P = I_G \bar{a} + \bar{r}_{G/P} \hat{?} m \bar{a}_G$$

$$\hat{?} \bar{M}_O = I_O \bar{a}$$

Slip vs No-slip kinematics

Contact friction and rolling resistance

W-E

$$T_1 + U_{1 \rightarrow 2} = T_2$$

Work of Force, Couple, Spring

Work of Friction:

(rolling vs. slipping)

Conservative Force and Couple

Conservation of Mech Energy

$$\sum_{i=1}^n \hat{?} (T_1)_i + \sum_{i=1}^n \hat{?} (U_{1 \rightarrow 2})_i = \sum_{i=1}^n \hat{?} (T_2)_i$$

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I-M

$$\sum_i m_i (\bar{v}_{G1})_i + \sum_i \left(\int_1^2 \bar{F} dt \right)_i = \sum_i m_i (\bar{v}_{G2})_i$$

$$\sum_i \bar{r}_{G/01} m \bar{v}_{G1} + \sum_i \left(\int_1^2 \bar{M}_0 dt \right)_i = \sum_i \bar{r}_{G/02} m \bar{v}_{G2}$$

Impulse of Force and Couple

Impulsive Force and Couple

Coef of Restitution

$$e = \frac{v_{cBN} \Big|_2 - v_{cAN} \Big|_2}{v_{cAN} \Big|_1 - v_{cBN} \Big|_1}$$

Conservation of Momentum

Summary for Test 3: Kinematics

- Kinematics with a point moving ON a body

$$\left(\bar{\mathbf{v}}_B\right)_{XYZ} = \left(\bar{\mathbf{v}}_A\right)_{XYZ} + \left(\bar{\mathbf{v}}_{B/A}\right)_{xyz} + \bar{\mathbf{W}} \times \bar{\mathbf{r}}_{B/A} \Big|_{xyz}$$

$$\begin{aligned} \left(\bar{\mathbf{a}}_B\right)_{XYZ} = & \left(\bar{\mathbf{a}}_A\right)_{XYZ} + \left(\bar{\mathbf{a}}_{B/A}\right)_{xyz} + \dot{\bar{\mathbf{W}}} \times \bar{\mathbf{r}}_{B/A} \Big|_{xyz} \\ & - \bar{\mathbf{W}}^2 \left(\bar{\mathbf{r}}_{B/A}\right)_{xyz} + 2\bar{\mathbf{W}} \times \bar{\mathbf{v}}_{B/A} \Big|_{xyz} \end{aligned}$$

$$\hat{\mathbf{i}} = (\cos q) \hat{\mathbf{I}} + (\sin q) \hat{\mathbf{J}}$$

$$\hat{\mathbf{j}} = -(\sin q) \hat{\mathbf{I}} + (\cos q) \hat{\mathbf{J}}$$

