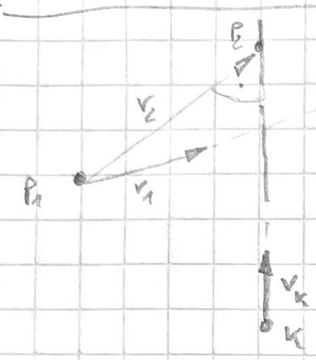
## LINE - LINE COPLANAR ROTATION




* find $P_2$ via projection of $P_1$ - finding via shortest distance is possible, but complex

$$P_2 = [(P_1 - k)^T \cdot v_k] \cdot v_k + k, \quad \Delta P = P_1 - k$$

$$P_2 = \Delta P^T \cdot v_k \cdot v_k + k$$

$$v_2 = P_2 - P_1 = \Delta P^T \cdot v_k \cdot v_k - P_1 + k$$

$$\dot{v}_2 = (\Delta \dot{P}^T \cdot v_k + \Delta P^T \cdot \dot{v}_k) v_k + \Delta P^T \cdot v_k \cdot \dot{v}_k - \Delta \dot{P}$$

$$\dot{v}_2 = \underbrace{\left[ v_k (v_k^T J_{\Delta P} + \Delta P^T J_{v_k}) + \Delta P^T \cdot v_k \cdot J_{v_k} - J_{\Delta P} \right]}_{J_{v_2}} \dot{q}$$

$$\dot{v}_1 = J_{v_1} \cdot \dot{q}$$

$$\dot{J}_{v_2} = \dot{v}_k (v_k^T J_{\Delta P} + \Delta P^T J_{v_k}) + v_k (\dot{v}_k^T J_{\Delta P} + v_k^T \dot{J}_{\Delta P} + \Delta \dot{P}^T J_{v_k} + \Delta P^T \dot{J}_{v_k}) - \dot{J}_{\Delta P}$$
$$+ (\Delta P^T \cdot v_k) \dot{J}_{v_k} + (\Delta \dot{P}^T v_k + \Delta P^T \dot{v}_k) J_{v_k}$$