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ASEN 5070
HW1

Problem 6 Supplemental: Finding the partials of the computed range

$$\rho_j = \sqrt{(X_0 - X_S + \dot{X}_0 t)^2 + (Y_0 - Y_S + \dot{Y}_0 t - g\frac{t^2}{2})^2}$$

$$\frac{\delta \rho_j}{\delta X_0} = \frac{1}{2} \cdot \frac{1}{\rho_j} \cdot \left(\frac{\delta}{\delta X_0}(X_0 - X_S + \dot{X}_0 t)^2 + \frac{\delta}{\delta X_0}(Y_0 - Y_S + \dot{Y}_0 t - g\frac{t^2}{2})^2 \right)$$ ($\to 0$)

$$= \frac{1}{\rho_j} \cdot (X_0 - X_S + \dot{X}_0 t) \cdot \frac{\delta}{\delta X_0}(X_0)$$ ($\to 1$)

$$\frac{\delta \rho_j}{\delta Y_0} = \frac{1}{\rho_j} \cdot (Y_0 - Y_S + \dot{Y}_0 t - g\frac{t^2}{2}) \frac{\delta}{\delta Y_0}(Y_0)$$ ($\to 1$)

$$\frac{\delta \rho_j}{\delta \dot{X}_0} = \frac{1}{\rho_j} \cdot (X_0 - X_S + \dot{X}_0 t) \frac{\delta}{\delta \dot{X}_0}(\dot{X}_0 t)$$ ($\to t$)

$$\frac{\delta \rho_j}{\delta \dot{Y}_0} = \frac{1}{\rho_j} \cdot (Y_0 - Y_S + \dot{Y}_0 t - g\frac{t^2}{2}) \frac{\delta}{\delta \dot{Y}_0}(\dot{Y}_0 t)$$ ($\to t$)

$$\frac{\delta \rho_j}{\delta g} = \frac{1}{\rho_j}(Y_0 - Y_S + \dot{Y}_0 t - g\frac{t^2}{2}) \frac{\delta}{\delta g}(-g\frac{t^2}{2})$$ ($\to -\frac{t^2}{2}$)