

ME 659 Multibody Dynamics

Exercises #2.1 Answers (Continuation of Exercises #2)

$$\text{a) } \{p_{G_3}\} = \{s_1\} + [R_{B_1}]^T (\{q'_2\} + \{s'_2\}) + [R_{B_2}]^T (\{q'_3\} + \{s'_3\}) + [R_{B_3}]^T \{r'_3\}$$

$$\text{b) } \{v_{G_3}\} = [v_{G_3, \dot{s}_1}] \{\dot{s}_1\} + [v_{G_3, \dot{s}'_2}] \{\dot{s}'_2\} + [v_{G_3, \dot{s}'_3}] \{\dot{s}'_3\} \\ + [v_{G_3, \dot{\theta}_1}] \{\dot{\theta}_1\} + [v_{G_3, \dot{\theta}_2}] \{\dot{\theta}_2\} + [v_{G_3, \dot{\theta}_3}] \{\dot{\theta}_3\}$$

where

$$[v_{G_3, \dot{s}_1}] = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$[v_{G_3, \dot{s}'_2}] = [R_{B_1}]^T$$

$$[v_{G_3, \dot{s}'_3}] = [R_{B_2}]^T$$

$$[v_{G_3, \dot{\theta}_1}] = -[R_{B_1}]^T ([\tilde{q}'_2] + [\tilde{s}'_2]) [\omega'_{B_1, \dot{\theta}_1}]$$

$$[v_{G_3, \dot{\theta}_2}] = -[R_{B_2}]^T ([\tilde{q}'_3] + [\tilde{s}'_3]) [\omega'_{B_2, \dot{\theta}_2}]$$

$$[v_{G_3, \dot{\theta}_3}] = -[R_{B_3}]^T [\tilde{r}'_3] [\omega'_{B_3, \dot{\theta}_3}]$$