ME 115(a): Homework #4

(Due Tuesday February 19, 2002)

Problem 1: Problem 11(a,b,d,e) in Chapter 2 of MLS.

Problem 2: Problem 14 in Chapter 2 of MLS.

Problem 3: Problem 15 in Chapter 2 of MLS.

Problem 4: Problem 18(e) in Chapter 2 of MLS.

Problem 5: Let B be a rigid body that is moving about according to $g(t)$, where $g(t) \in SE(3)$ measures the location of a frame fixed to the moving body with respect to a stationary frame. Assume that points P, Q, and R are fixed in this moving body. Further assume that the coordinates of these points, as seen by an observer in a frame affixed to the body, are $\vec{v}_1$, $\vec{v}_2$, $\vec{v}_3$. Assume that at a given instant of time, t_0, we can measure both the location of the points P, Q, and R, as well the velocities of these points, $\dot{P}$, $\dot{Q}$, and $\dot{R}$— as seen by an observer in the stationary frame. Show how to compute either the spatial or the body velocity of B from this information.

The solution to this problem is at the foundation of some "motion capture" algorithms.