ME 115(a): Homework #4

(Due Thursday November 11, 1999)

Problem 1:

Part (a): Assume that the orientation of a rigid body is described by z-y-z Euler angles, where the angles of rotation are respectively ψ, ϕ, and γ. Further assume that the body is spinning with rotation rates of $\dot{\psi}$, $\dot{\phi}$, and $\dot{\gamma}$ about the respective z, y, and z axes. Show that the spatial angular velocity of the body is:

$$\vec{\omega}^s = \begin{bmatrix} -\dot{\phi}\sin\psi + \dot{\gamma}\cos\psi\sin\phi \\ \dot{\phi}\cos\psi + \dot{\gamma}\sin\psi\sin\phi \\ \dot{\psi} + \dot{\gamma}\cos\phi \end{bmatrix}$$

Note that the solution to this problem is useful for the study of gyroscopes.

Problem 2: Problem 13 in Chapter 2 of MLS.

Problem 3: Problem 14 in Chapter 2 of MLS.

Problem 4: Problem 16 in Chapter 2 of MLS.

Problem 5: Problem 18(c,d,e) in Chapter 2 of MLS.