## ME 115(a): Homework #4

(Due Thursday, February 23, 2006)

## Problem 1:

Assume that the orientation of a rigid body is described by z-y-x Euler angles, where the angles of rotation are respectively  $\psi$ ,  $\phi$ , and  $\gamma$ . Further assume that the body is spinning with rotation rates of  $\dot{\psi}$ ,  $\dot{\phi}$ , and  $\dot{\gamma}$  about the respective z, y, and x axes. Derive a formula for the spatial angular velocity as a function of the variables  $\psi$ ,  $\phi$ ,  $\gamma$ ,  $\dot{\psi}$ ,  $\dot{\phi}$ , and  $\dot{\gamma}$ .

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

**Problem 2:** Problem 11(d,e) in Chapter 2 of MLS.

**Problem 3:** Problem 13(a,b) in Chapter 2 of MLS.

**Problem 4:** Problem 14(b) in Chapter 2 of MLS.

**Problem 4:** Problem 16(a,b) in Chapter 2 of MLS.

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