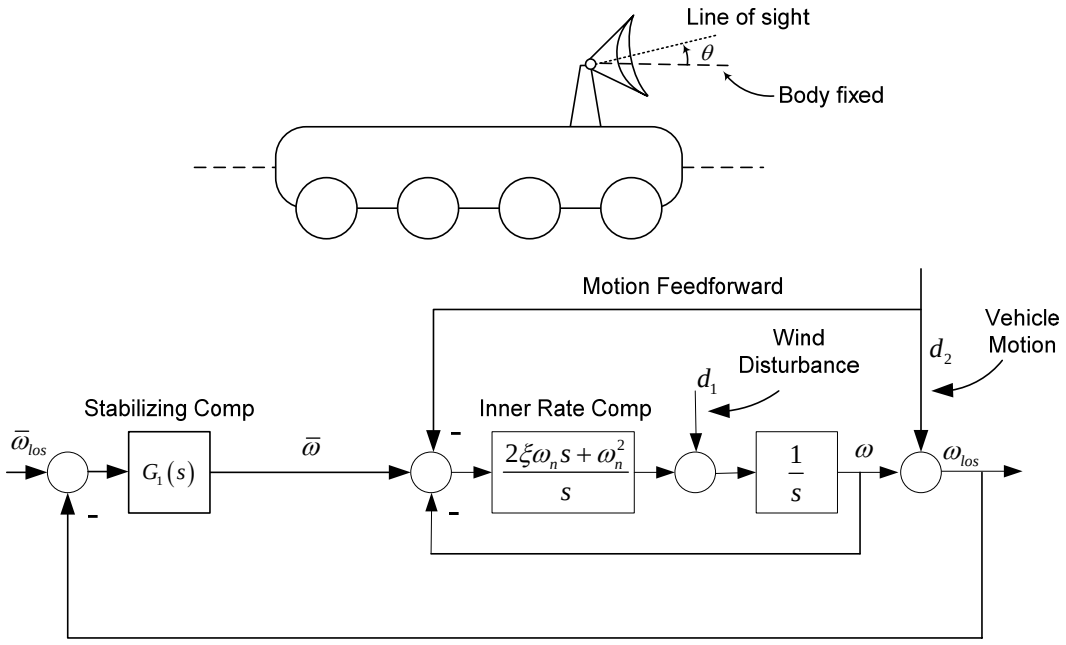
EE 380 PROJECT
DUE DATE JANUARY 17 IN CLASS

INSTRUCTIONS:

- **You may collaborate with up to one more student, and hand in a single project report.**
- **Explain and discuss your results – think in terms of a brief technical report.**
- **A hard copy must be turned in. Electronic versions are also needed.**
- **All computations are to be done using MATLAB.**



A communication antenna is mounted on a moving vehicle. It is required to precisely regulate the antenna line of sight event though the vehicle is subjected to significant pitching motion and the antenna is subjected to wind loads.

The relatively complex control system consists of 2 compensators and motion disturbance feedforward. The inner rate compensator controls the motor drive that rotates the antenna relative to its base that is fixed in the vehicle. The stabilizing compensator is intended to eliminate antenna line of sight movement due to vehicle motion disturbance, and the disturbance rejection compensator is intended to protect line of sight motion due to wind disturbances. The sensors are:

1. an encoder is used to measure antenna rotation (relative to its base), ω, θ
2. a rate gyro mounted on the antenna measures line of sight angular velocity, ω_{los}
3. a second rate gyro mounted on the vehicle measures vehicle angular velocity, d_2

Use the following data:

$$\omega_n = 100, \xi = 0.707$$

$$G_1(s) = K\frac{\left(s^2 + 2\xi\omega_n s + \omega_n^2\right)}{s(s+\gamma)}, \quad K = 1, \gamma = 10$$

Compute the following:

1. The three transfer functions $\bar{\omega}_{\ell os} \to \omega_{\ell os}, d_1 \to \omega_{\ell os}, d_2 \to \omega_{\ell os}$
2. Compute the line of sight angular velocity response to
    a. step command,
    b. impulse wind disturbance
    c. impulse vehicle disturbance
3. Remove the motion feedforward connection and recompute the transfer function $d_2 \to \omega_{\ell os}$. Compare the impulse response to that of 2c)
4. Compare the bode plots of the transfer functions $d_2 \to \omega_{\ell os}$ computed in 1) and 3).

Explain your results.