INSTITUTO TECNOLÓGICO DE AERONÁUTICA
MP-282: Dynamic Modeling and Control of MAVs
Simulation Exercise 1

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Using a MATLAB script, implement a simulation program for the 2D MAV flight control system described by the block diagram in Figure 1.

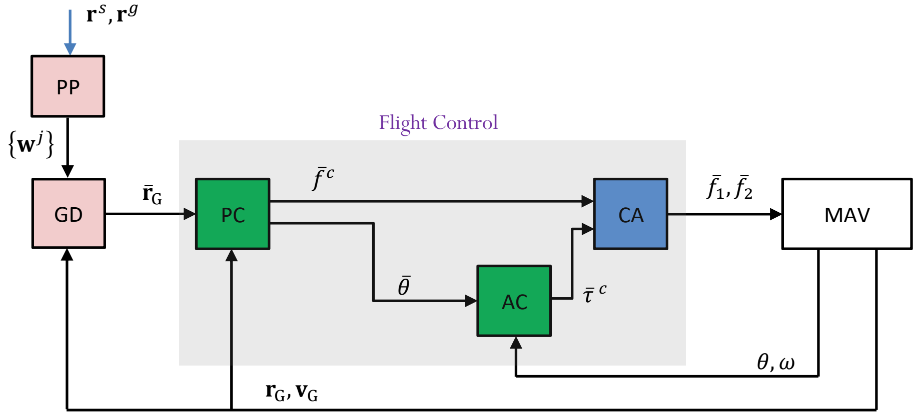

Figure 1: Flight control system of a 2D MAV (see Chapter 1 of MP-282).

Consider that the flying environment is rectangular with vertices at $\{(0,0),(0,3),(4,3),(4,0)\}$ m and that there exist two rectangular obstacles at $\{(1,1),(1,2),(1.5,2),(1.5,1)\}$ m and $\{(2.5,2),(2.5,3),(3,3),(3,2)\}$ m, respectively. The starting point is $\mathbf{r}^s = (0.5, 1.5)$ m and the goal point is $\mathbf{r}^g = (3.5, 2.5)$ m.

The waypoints that compose the path can be chosen manually as illustrated in slide 20 of Chapter 1. In this case, the PP block will not be implemented in this exercise. The GD block must be implemented according to slides 19–20 of Chapter 1. As a starting point, I suggest using $\mathbf{K}^g = \mathbf{I}_2$.

Adopt the following parameters: $m = 1.0$ kg, $l = 0.2$ m, $J = 0.02$ kgm^2, $g = 9.81$ m/s^2, and $T_s = 0.01$ s. Moreover, tune K_1, K_2, $\mathbf{K}_3$, and $\mathbf{K}_4$ by trial and error (but taking into account the time-scale separation assumption discussed in Chapter 1). As a starting point, I suggest using $K_1 = 6$, $K_2 = 3$, $\mathbf{K}_3 = 0.2\mathbf{I}_2$, and $\mathbf{K}_4 = 0.8\mathbf{I}_2$. Finally, consider that the rotors are perfectly modeled and, therefore, one can consider $f_1 = \bar{f}_1$ and $f_2 = \bar{f}_2$. Write a short report presenting simulation plots (of your choice) and discussing the results.