ROBUST CONTROL

Exercise 3 – Elements of Linear System Theory, MIMO Systems and Norms

1. Determine the poles and zeros of:

$$G(s) = \begin{bmatrix} \dfrac{11s^3 - 18s^2 - 70s - 50}{s(s+10)(s+1)(s-5)} & \dfrac{s+2}{(s+1)(s-5)} \\ \dfrac{5(s+2)}{(s+1)(s-5)} & \dfrac{5(s+2)}{(s+1)(s-5)} \end{bmatrix}$$

   How many poles and zeros does $G(s)$ have? Extract the corresponding directions. If possible, find an appropriate input signal that does not affect the output and simulate it.

2. You are given the system

$$G(s) = \frac{1}{10s+1}\begin{bmatrix} 1 & -0.9 \\ 7 & 2 \end{bmatrix}$$

   and the controller

$$K(s) = \frac{10s+1}{10s}\begin{bmatrix} 1 & 0 \\ 0 & 0.5 \end{bmatrix}$$

   Calculate the H-infinity norm of the sensitivity matrix and the corresponding frequency. Find the normalized reference signal $r(t)$ that yields the maximum tracking error. Plot the corresponding signals.