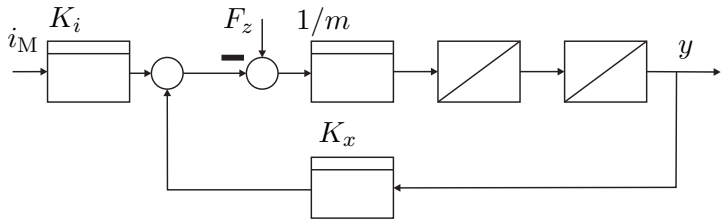
Exercise Sheet 7: Pole Placement

Problem 14:

We again consider the magnetic suspension system. The following figure provides a block diagram of the linearized magnetic suspension system and the table summarizes the relevant system parameters.



$K_x = 100\,\mathrm{N/m}$	$K_i = 1\,\mathrm{N/A}$	$m = 0.1\,\mathrm{kg}$	$d = 0.04\,\mathrm{m}$

It is desired to achieve a closed-loop behavior with real poles at $s = -10$.

a. What is the required controller order if the pole placement method is used? What is the expected controller type?

b. Apply pole placement to design an appropriate controller $C(s)$. Also use a pre-filter $F(s)$ if required.

c. Which steady-state error do you expect for reference steps and disturbance steps?

Problem 15:

a. Realize the feedback loop computed in Problem 14 **b.** without the pre-filter and simulate a reference step response of $r = 1\,\mathrm{cm}$ and a disturbance step response of $F_L = 0.05\,\mathrm{N}$. Also record the plant input u.

b. Realize the feedback loop for Problem 14 **b.** including the pre-filter and perform the same experiments as in **a.** Compare the results.

c. What is the advantage of the pole-placement method compared to the Youla parametrization?