Homework 02 - due Saturday April 10th, 2021.

The goal of this homework is to get acquainted with the derivation of the extended plant, starting evaluating the effects of uncertainties and exploring the limitations that arise when the plant has an unstable pole and/or a non-minimum phase zero.

Problem 1
Use the armature controlled DC motor linear model of your Homework01 (you can of course enrich it).

1. Obtain the extended plant with all three weighting functions and compare the results you obtained with `mixsyn` with the one you obtain using directly `hinfsyn` on the extended plant (you should obtain similar results).
2. We have seen that we may sometimes neglect the high frequency dynamics relating to the presence of the motor inductance. Explore and comment on your example (probably also changing closed loop specifications).
3. Try to find a weight that may represent this neglected dynamics.
4. Explore the behavior of your controller designed for a nominal DC motor when you apply it to an uncertain DC motor model where the parameters are vary in some intervals or in percentage (try to remain to realistic values).

Problem 2
You have a small report on the modeling of a pendulum on a cart (there may be typos, if any post them in the group). You will see that, depending on which input and output you consider, the resulting transfer functions have different characteristics. Try to explore and illustrate as much as possible what you have learned on the limitations due to the presence of zeros and poles belonging to the Right-Half Plane (RHP). The more effort you will put in exploring these results the better the evaluation.

Comments:

- Again, there is a lot of flexibility in the choices you can make, be as clear as possible in explaining what you do.
- There are some numerical tools which can also be useful, for example in computing the areas, see the accompanying Matlab file `Area_Formula_Limited_Bandwidth_ex.m`.