HOMEWORK # 5 - Deadline : January 13, 2020

Consider the one-machine infinite-bus system detailed in the theoretical slides.

To damp the electromechanical mode λ_c (see Exercise 1 in the course slides), the machine is equipped with a PSS using the following input:

Variant	1	2	3	4
PSS input	$-P$	ω	$-P$	ω
m	1	2	1	2

P : active power produced

Step 1

Identify the residue R_c of the λ_c eigenvalue.

Suggestion: the Matlab functions `ss2tf` and `residue` can be very useful.

Step 2

Choose the values of T_z, T_p and T_w in the PSS transfer function:

$$G(s) = \frac{s}{1 + sT_w} \left(\frac{1 + sT_z}{1 + sT_p} \right)^m$$

where m is given in the above table.

Step 3

- Extend the Matlab script `omib.m` to include the differential-algebraic equations and the states corresponding to the PSS. Use Homework 3 !
- Check: when K_{pss} is set to zero:
  - verify that the previous eigenvalues are unchanged
  - check the eigenvalues stemming from the PSS.
- Increase K_{pss} progressively until obtaining a damping ratio $\xi = 0.20$ for the electromechanical mode λ_c.
- While K_{pss} is increased, check that no other eigenvalue moves to an unsatisfactory value.

Step 4

Determine the stability limits of Exercise 3 in the presence of the PSS.
How does the PSS affect the limits ?

As usual, explain your derivations in detail and append your Matlab code.