Experiment 9

Simulation and control design on Simulink as a CAD interface to MATLAB.

Background:

Simulink is the CAD interface for MATLAB Control Systems Toolbox, so practically all that we can do on MATLAB may be more conveniently done on the Simulink platform with the convenience of CAD.

While the user "draws" a control system on his Simulink interface, the simulation gets created on MATLAB in the background, by which it may be accordingly simulated.

Objective:

Analyse the effectiveness of *Ziegler-Nichols* rules in presence of poles with *high multiplicity*.

Tutorial:

Simply rehash the Simulink Primer in your Lab account, unless already done so.

Elements of the software for familiarisation:

Simulink has considerable menu driven and iconised options. They are substantial, and one obviously familiarises as one uses them.

Project:

The *basic OLTF unit* provided to you is to be *considered at different multiplicities* (say multiplicity order of *one* to *ten*, as an example).

$$G(s) = \frac{1}{(s+1.5)^k} \quad ; \quad k = 1 \ldots 10$$

For each multiplicity, create a block diagram on Simulink, and conduct the appropriate Ziegler-Nichols test (OL for lag systems, CL for oscillatory systems). Hence obtain the tuned constants for *P*, *PI*, and *PID* control by the ***Ziegler Nichols rules***.

Cascade the respective controllers to the OLTF systems you have created in Simulink files.

For observations and discussions:

With the *unit step* as the change in CLTF reference, obtain *the dynamic response* on screen.

In terms of different dynamic performance measures (say *rise time*, *peak overshoot*, *settling time*, etc.) analyse the effectiveness of the "***ZN rules***" for multiple poles systems. Discuss the merits or demerits exhaustively in terms of the performance measures that you choose to tabulate and report.