ECE473 CONTROL OF POWER SYSTEMS

Lab # 7 – Voltage Control of a Turboalternator

1. Perform HW8 as the pre-lab.

2. Simulate removing the stabilizer and repeat part 1. What is the maximum value of K_A that will keep the damping ratio above 0.1?

3. Re-apply the stabilizer, set $K_A = 10$ and determine the minimum value of K_{st} that will keep the damping ratio above 0.1?

HW # 8 – Voltage Control of a Turboalternator

1.

a) Why is it important that the open-loop gain of a turboalternator's voltage regulator be high? What considerations should be given to selecting the open-loop gain?

b) The block diagram of a voltage regulator is shown in the notes. If $|V|_{ref}$ has been set at 1.02 pu for a long time, apply the final value theorem to determine:

i) the value of $|V|$ before any adjustments, and

ii) if $|V|_{ref}$ is increased to 1.05 pu, what will be the steady-state value of $|V|$?

$K_A = 10,$	$K_E = 5,$	$K_r = 2.5,$	$K_{st} = 0.05$
$T_A = 0.15,$	$T_E = 1.5,$	$T_r = 10,$	$T_{st} = 0$

2.

a) The parameters of a standard voltage regulator are shown below. The $|V|_{ref}$ setting has been turned off for a long time; apply the final value theorem to determine the % error if $|V|_{ref}$ is suddenly increased to 1.05 pu.

b) Use Simulink to obtain the step response for the conditions in part (a). Assume that the response is second-order dominated and determine: damping ratio (ζ), undamped natural frequency (ω_o), and damped natural frequency (ω_d).

$K_A = 10,$	$K_E = 5,$	$K_r = 2.5,$	$K_{st} = 0.05$
$T_A = 0.15,$	$T_E = 1.5,$	$T_r = 10,$	$T_{st} = 0$