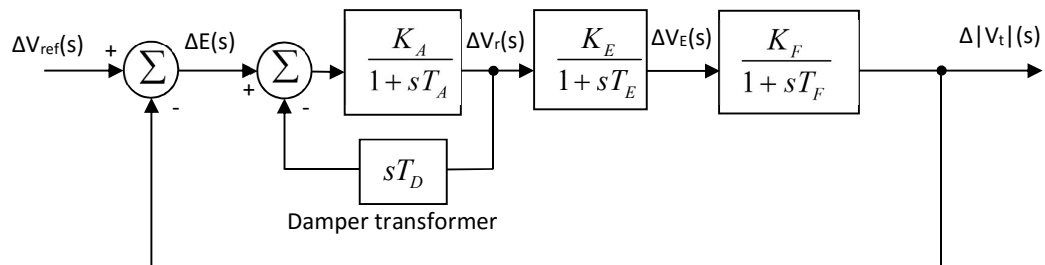


Please write your FULL NAME clearly. Submit the softcopy of your Assignment 3 solutions by 27 April 2020 (Monday) to [eddyfoo@ntu.edu.sg](mailto:eddyfoo@ntu.edu.sg).

Written or typed solution is accepted.

### EE6511: Assignment 3

1. A salient pole synchronous generator is connected to an infinite bus and has  $X_d = 1.4$  pu,  $X_q = 1$  pu and negligible resistance. The infinite bus voltage is 1 pu and the interconnection impedance between the infinite bus and the generator terminal is negligible. The generator is operating with an excitation e.m.f of 1.2 pu and a synchronizing coefficient of -0.2 pu MW / degree.
  - (a) Calculate the power angle ( $\delta$ ) of the generator. (8 Marks)
  - (b) Based on the above operating condition, determine whether the generator is over-excited or under-excited. Hence, calculate the generator current and state whether the generator is overloaded. (5 Marks)
  - (c) Calculate the pull-out power angle of the generator and determine whether the generator is stable. Comment on your answers. (7 Marks)
  - (d) The excitation system of a generator with damper transformer can be represented by the transfer function model as shown in Figure 1, where  $T_A = 0.5$  sec,  $K_E = 1$ ,  $T_E = 1$  sec,  $K_F = 1$  and  $T_F = 2$  sec. It is required that the static error does not exceed 1%. If  $T_D = 0.5$  sec, determine the range of  $K_A$  for the excitation system to be stable and show that the stability requirement conflicts with the static error requirement. Hence, briefly comment on how this conflicting requirement can be solved.



**Figure 1**

(10 Marks)