X370993

UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE

Department of Electrical Engineering

The Effects of Pole Locations on System Response

INTRODUCTION

The transfer function for all control systems have closed-loop poles that have little or no effect upon the response of the system. Most often, the parameters that produce such poles are never included in the analysis (i.e., distributed inductance and capacitance, etc.). Oftentimes it becomes a matter of judgement and experience as to whether such parameters can be neglected or not. In borderline cases, a very rigorous and complete analysis must be done before such a decision can be made. The pole(s) that most affect the response of a system are called dominant pole(s) and are those closest to the imaginary axis in the s-plane.

ASSIGNMENT

The student is to illustrate the principle discussed above by simulating the attached transfer functions on the digital and analog computers.

REFERENCES

1. References on reserve in the library.
2. Textbooks on the subject of automatic or feedback control systems.
3. Faculty with expertise in the area of automatic control systems.

EXPECTED RESULTS (as a minimum)

1. A pole-zero plot on the S-plane showing all the pole locations of the given transfer functions, G1(S) - G4(S).
2. Time-response plots of the given transfer functions.
3. A discussion of the time-response plots defining the dominant poles and pointing out the effect of adding additional poles at various locations relative to the dominant poles on the response of the system.

HELPFUL HINT:
1. Plot g1(t), g2(t), and g5(t) on the same graph.
2. Plot g1(t), g3(t), and g6(t) on the same graph.
3. Plot g1(t), g4(t) and g7(t) on the same graph.

TRANSFER FUNCTIONS

$$G1(S) = \frac{0.5}{s^2 + s + 0.5}$$

$$G2(S) = \frac{2}{s^2 + 2s + 2}$$

$$G3(S) = \frac{8}{s^2 + 4s + 8}$$

$$G4(S) = \frac{32}{s^2 + 8s + 32}$$

$$G5(S) = \frac{1}{s^4 + 3s^3 + 4.5s^2 + 3s + 1}$$

$$G6(S) = \frac{4}{s^4 + 5s^3 + 12.5s^2 + 10s + 4}$$

$$G7(S) = \frac{16}{s^4 + 9s^3 + 40.5s^2 + 36s + 16}$$