16.06 Lecture 10
The Effect of Zeroes

Karen Willcox

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Today's Topics

1. Zero near a dominant quadratic mode
2. General observations on the effect of a zero
3. Other examples of the effects of zeroes

Reading: 5.3, l.n.

1 Zero near a dominant quadratic mode

This situation usually results when we add a PD controller.

$$G(s) = \frac{\omega_n^2}{z_1} \frac{s + z_1}{s^2 + 2\zeta\omega_n s + \omega_n^2}$$

$$c(t) =$$

If $A \approx z_1$ and $\alpha \approx 0$, then $c(t)$ is the standard second-order response.

A far away zero has negligible effect.

As the zero is moved to the right, it has a greater effect as follows:

$$T_p =$$

$$P.O. =$$

Example:

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2 General observations on the effect of a zero

Given $G(s) = \frac{4}{a}\frac{s+a}{(s+1)(s+4)}$

(a) Step response

$$c(t) =$$

Note:

(b) Observations:

(i)

(ii)

(iii)

(iv)

3 Other examples of the effects of zeroes

- Another way to look at the effect of a zero

Suppose we have the closed-loop transfer function

$$\frac{C(s)}{R(s)} = \frac{N(s)}{D(s)}$$

Consider a single zero on the real axis

$$\frac{C(s)}{R(s)} =$$

and a step input

$$C(s) =$$

Then the time response can be written as

$$c(t) = c_1(t) + c_2(t)$$

$$c_1(t) =$$

$$c_2(t) =$$

Now $c_2(t)$ is the

$c_1(t)$ is the

$c_1(t)$ is the

$$c(t) =$$

- Discussion of attached figures.