BIOEN 302

Lecture 8

Poles, stability, and the s-plane

October 12, 2007

Before we begin…

- New dates
  - Homework 3 due Wed. October 17
  - Quiz 2 on Fri. October 19

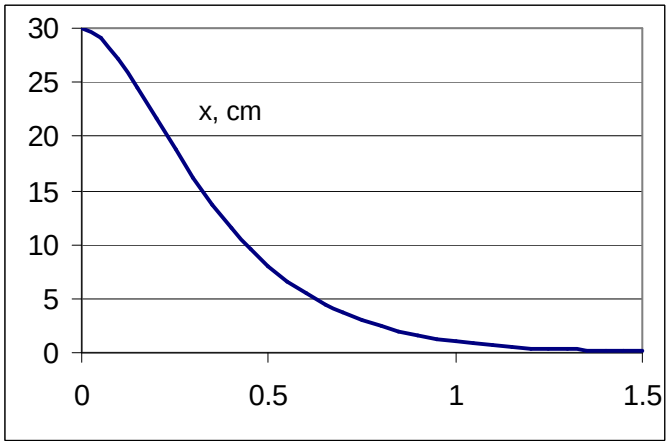
- Save your concerns and your latest brilliant thoughts for after class
- Plan your work time for the week.

Homework 2 solution

- Critically damped system:
  $v(t) = Ae^{-st} + Bte^{-st}$
- Initial conditions:
  $x(0)=30$ cm, $x'(0)=0$
  give $A=30$ cm, $B= -As$
- $X(1)/x(0) = 1/30 = e^{s}(1-s)$
  solve iteratively to get $s = -5.2$
- Char. Eqn.: $ms^2 + bs + k = 0$
  $-5.2 = -b/2m \rightarrow b = 20.8$

Corrected solution for Homework 2

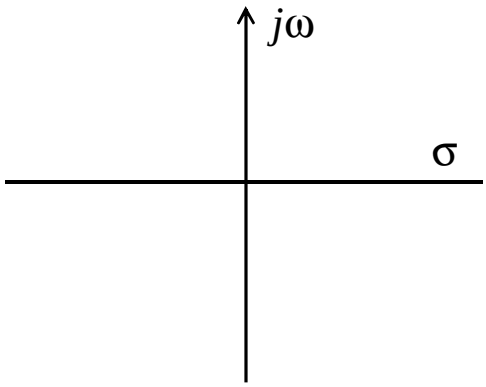
- Complete solution:
  $x(t) = 30e^{-5.2\,t} + 156te^{-5.2\,t}$



THE Frequency Domain

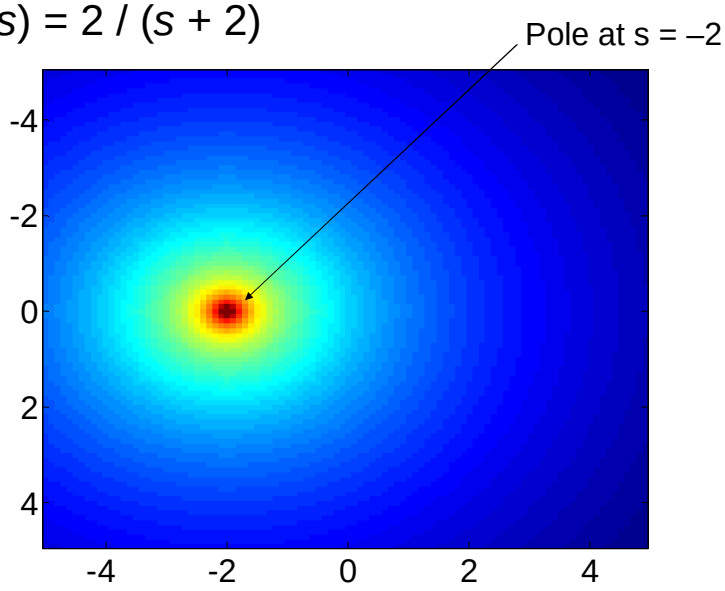
- The *s* plane

  $s = \sigma + j\,\omega$, as in $x(t) = e^{st} = e^{(\sigma + j\omega)t}$



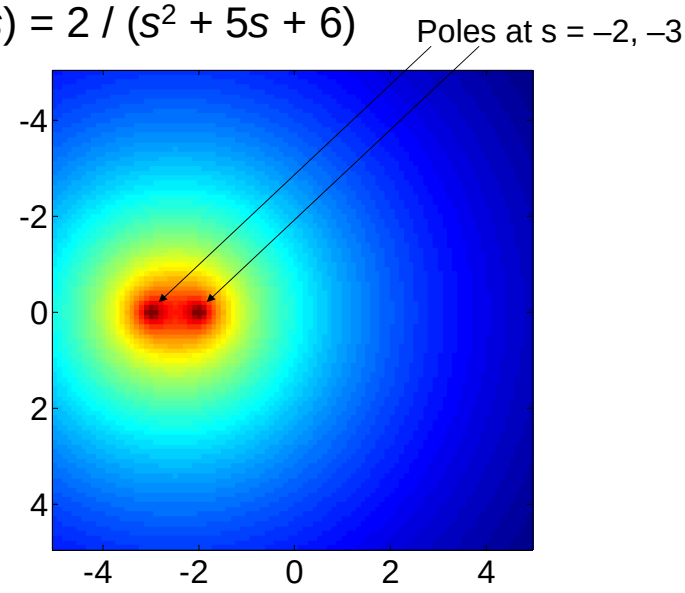
Transfer functions in the s-plane

$H(s) = 2 / (s + 2)$



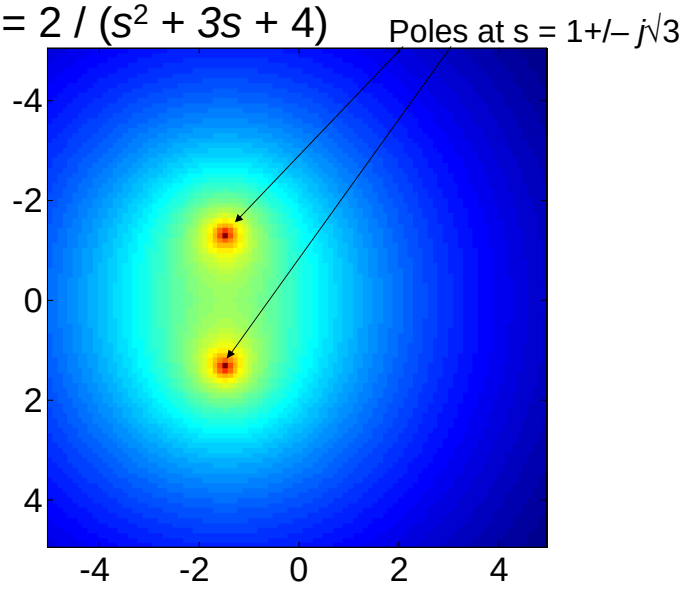
Transfer functions in the s-plane

$H(s) = 2 / (s^2 + 5s + 6)$



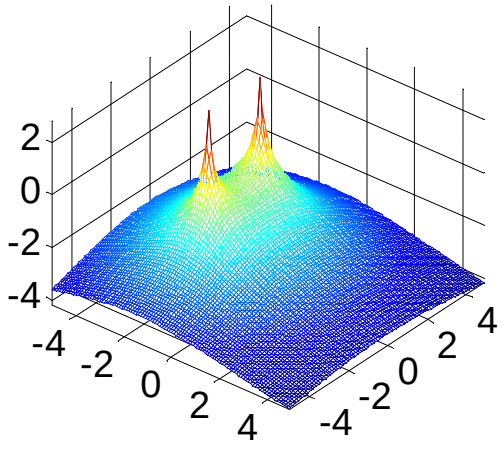
Transfer functions in the s-plane

$H(s) = 2 / (s^2 + 3s + 4)$



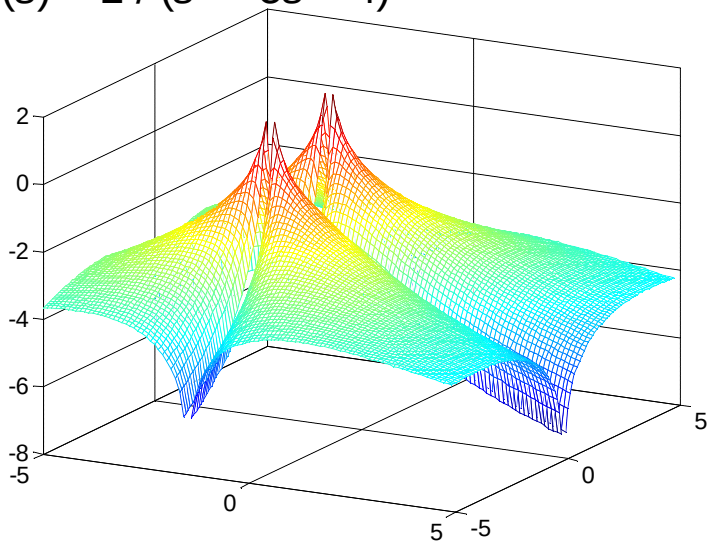
Transfer functions in the s-plane

$H(s) = 2 / (s^2 + 3s + 4)$



Imaginary part of transfer function

$H(s) = 2 / (s^2 + 3s + 4)$



Phase of transfer function