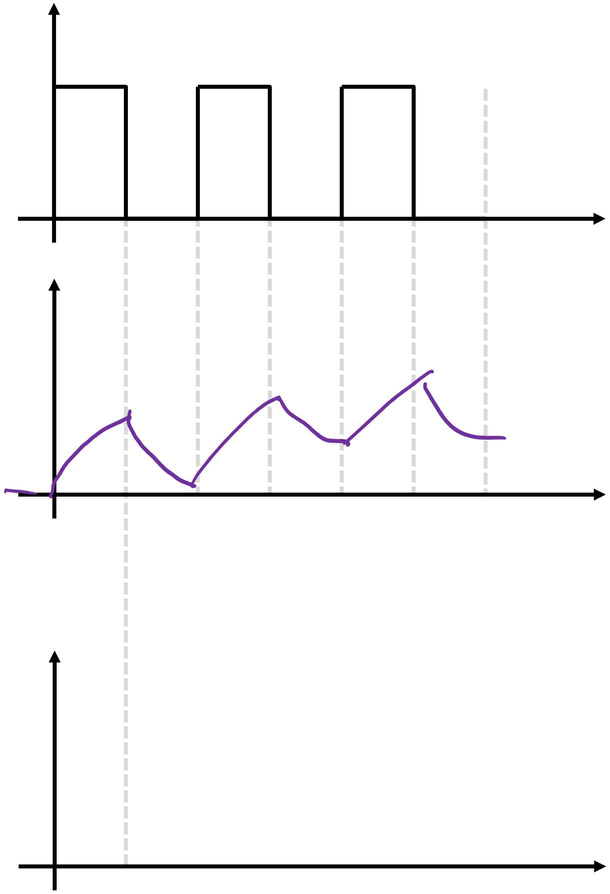
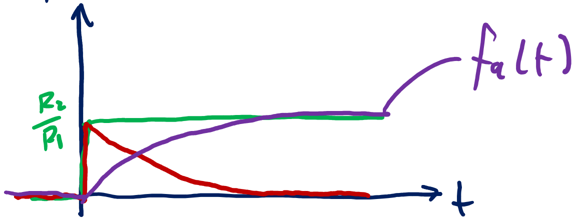


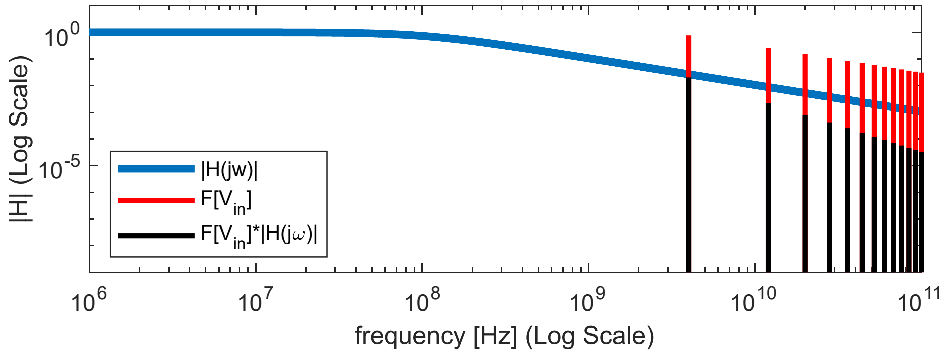
$$f_a(t) = \frac{R_2}{R_1}\left[1 - e^{-\frac{1}{R_2 C}t}\right]u(t)$$

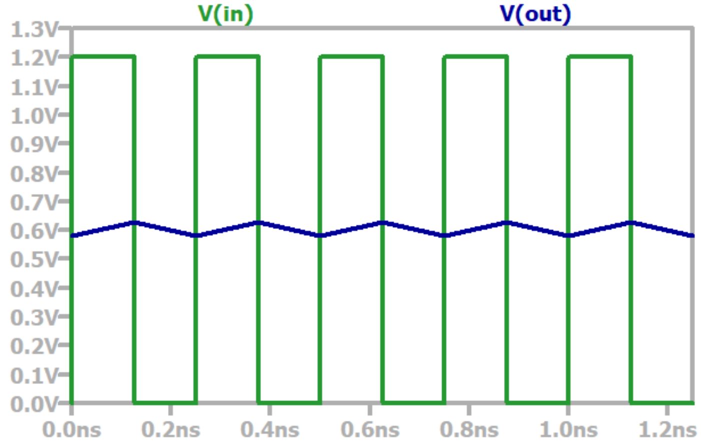


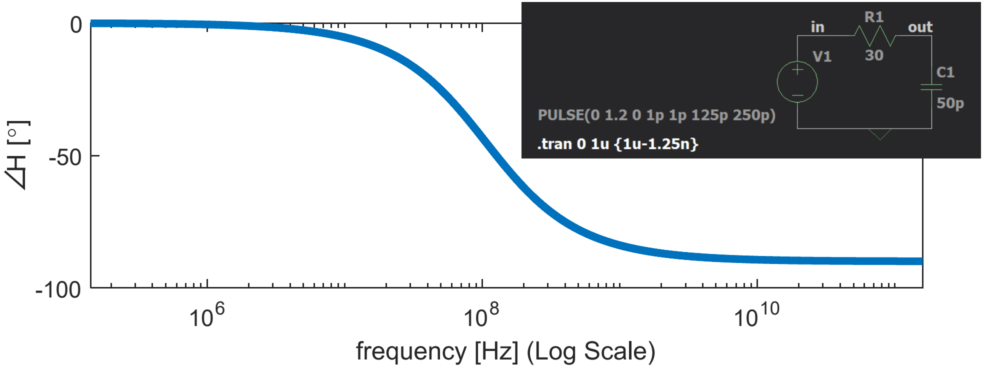
End of Material for Midterm 2

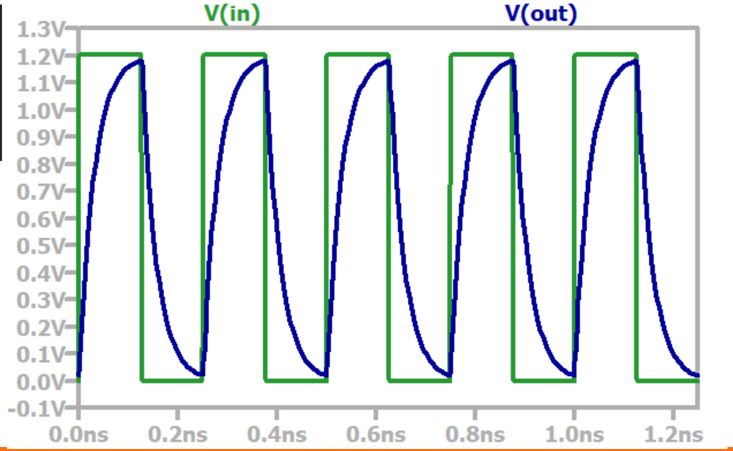
- Midterm Exam #2 Friday Apr 26th
  - Lectures 20 -33
  - Homeworks 6 - 9
  - Quiz 3 - 4
  - Chapter 17 (17.1 -17.5) and Chapter 14 (all)
  - Experiment 3

L22 - Frequency Response Interpretation







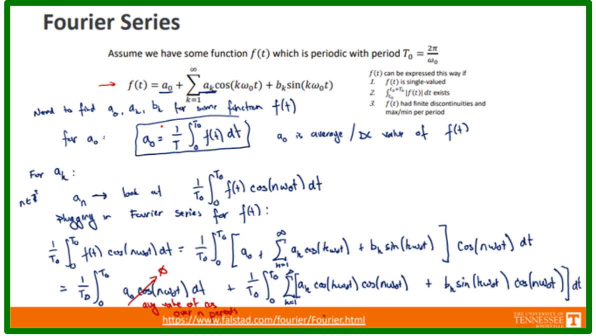


Laplace Explanation

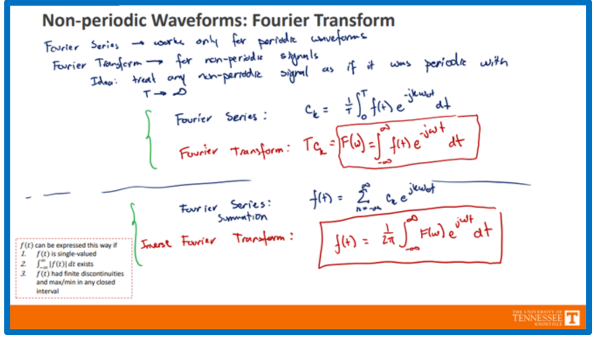
$$F(s) = \int_{0^-}^{+\infty} e^{-st} f(t)\, dt = \int_{0^-}^{+\infty} e^{-\sigma t} e^{-j\omega t} f(t) dt$$

$$f(t) = \frac{1}{2\pi j} \int_{\sigma_0 - j\infty}^{\sigma_0 + j\infty} e^{\sigma t} e^{j\omega t} F(s)\, ds$$

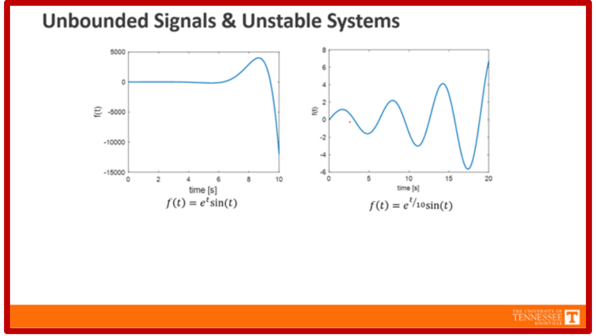
L21



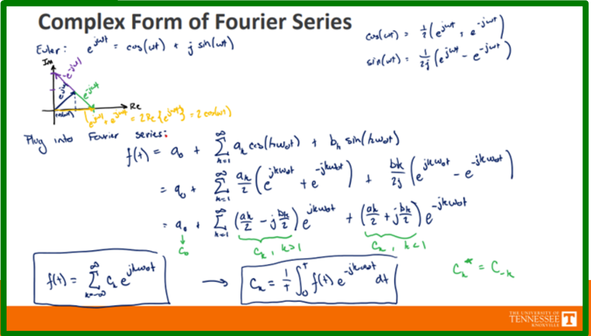
L24



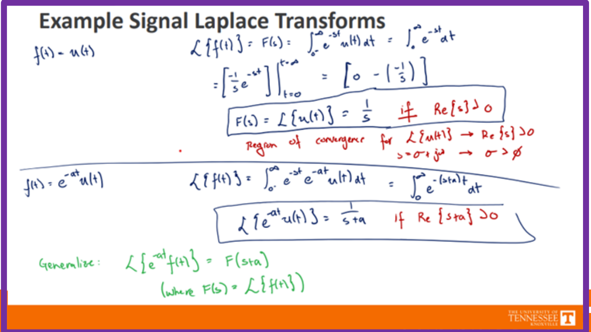
L30



L23



L25

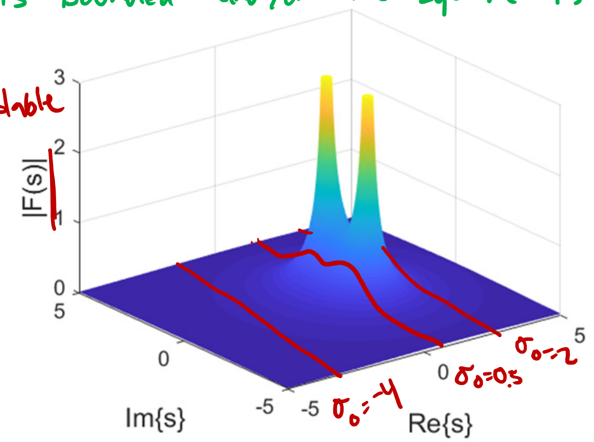


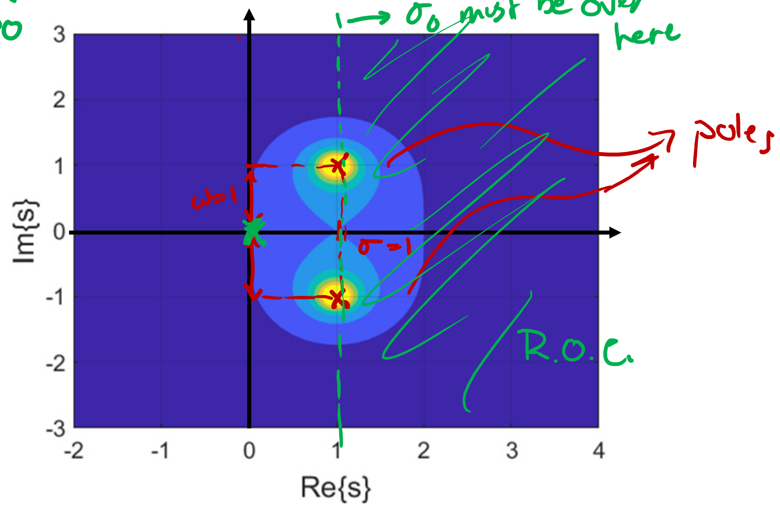
The s-plane

The Region of convergence of a Laplace transform is the complex plane to the right of all poles

If all poles are in the open left half-plane, (LHP) the signal is bounded and/or the system is BIBO stable

RHP poles ⟺ Unstable





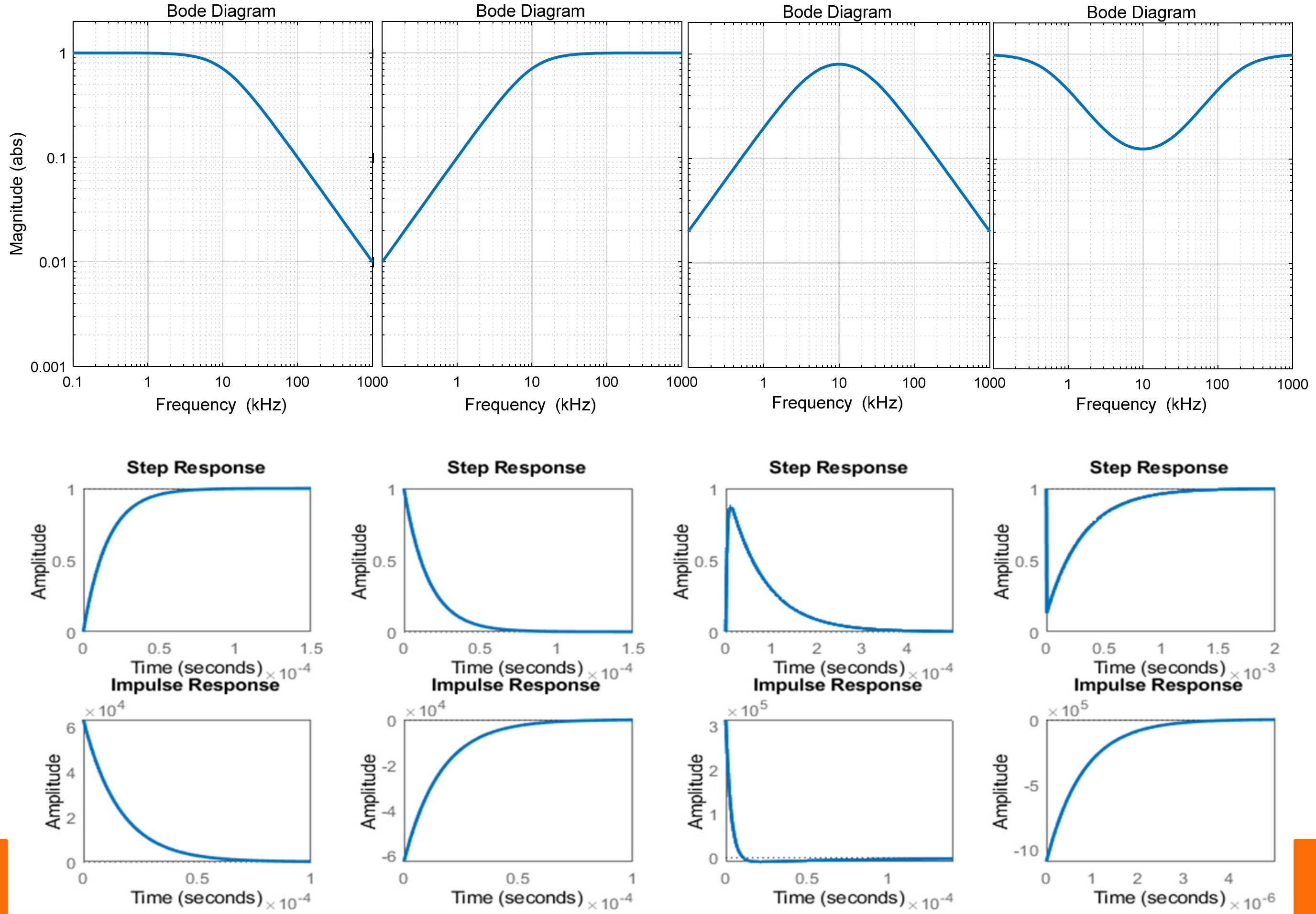
$$F(s) = \frac{1}{s^2 - 2s + 2} = \frac{1}{(s-(1+j))(s-(1-j))}$$

$f(t) = e^t \sin(t)$

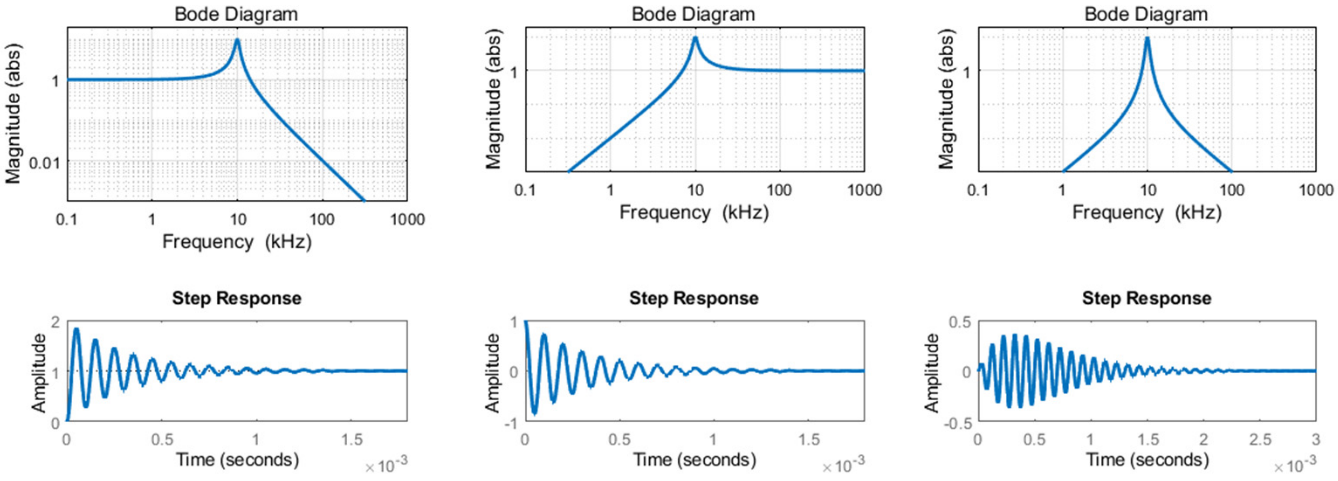
ROC is $Re\{s\} > 1$

$F(s) = \int_{0^-}^{\infty} e^{-st} e^t \sin(t)\,dt$ → Need $Re\{s\} > 1$ for convergence

Frequency Response and Circuit Behavior



Complex Poles



Bode Plots