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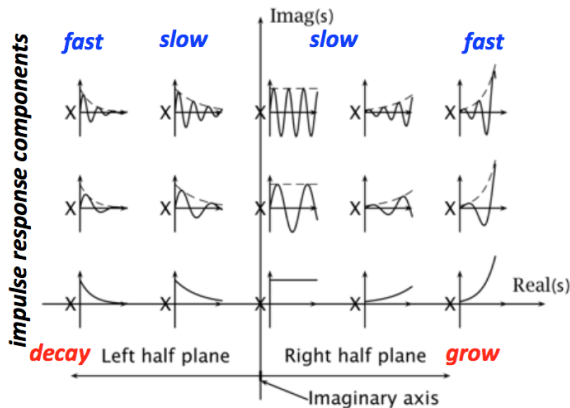
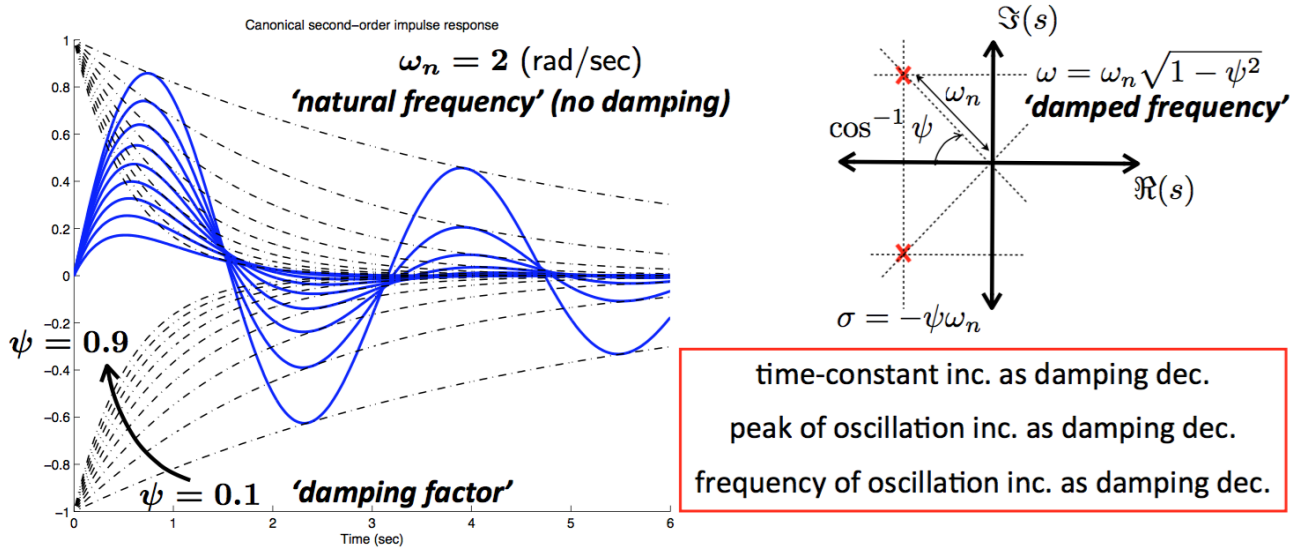
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2 Pole-zero plot(2013 Q2, 2012 Q4)

- Pole plot and the correspond time domain step response

$$\ddot{y}(t) + 2\psi\omega_n\dot{y}(t) + \omega_n^2y(t) = \omega_n^2u(t) \quad \leftrightarrow \quad G(s) = \frac{Y(s)}{U(s)} = \frac{\omega_n^2}{s^2 + 2\psi\omega_n s + \omega_n^2}$$

for $0 < \psi < 1$ the poles are $\frac{-2\psi\omega_n \pm \sqrt{(2\psi\omega_n)^2 - 4\omega_n^2}}{2} = -\psi\omega_n \pm j\omega_n\sqrt{1-\psi^2}$



- response due to poles with +ve real part *grows* and these are said to be '**unstable**'
- response due to poles with -ve real part *decays* and these are said to be '**stable**'
- response due to imaginary axis poles is bounded if not repeated, else response grows
- a stable response is *dominated* by '**slowest**' poles (i.e. closest to imaginary axis)