EENG307: Second Order Systems[1]

Lecture 11

Elenya Grant, Kathryn Johnson, and Hisham Sager[2]

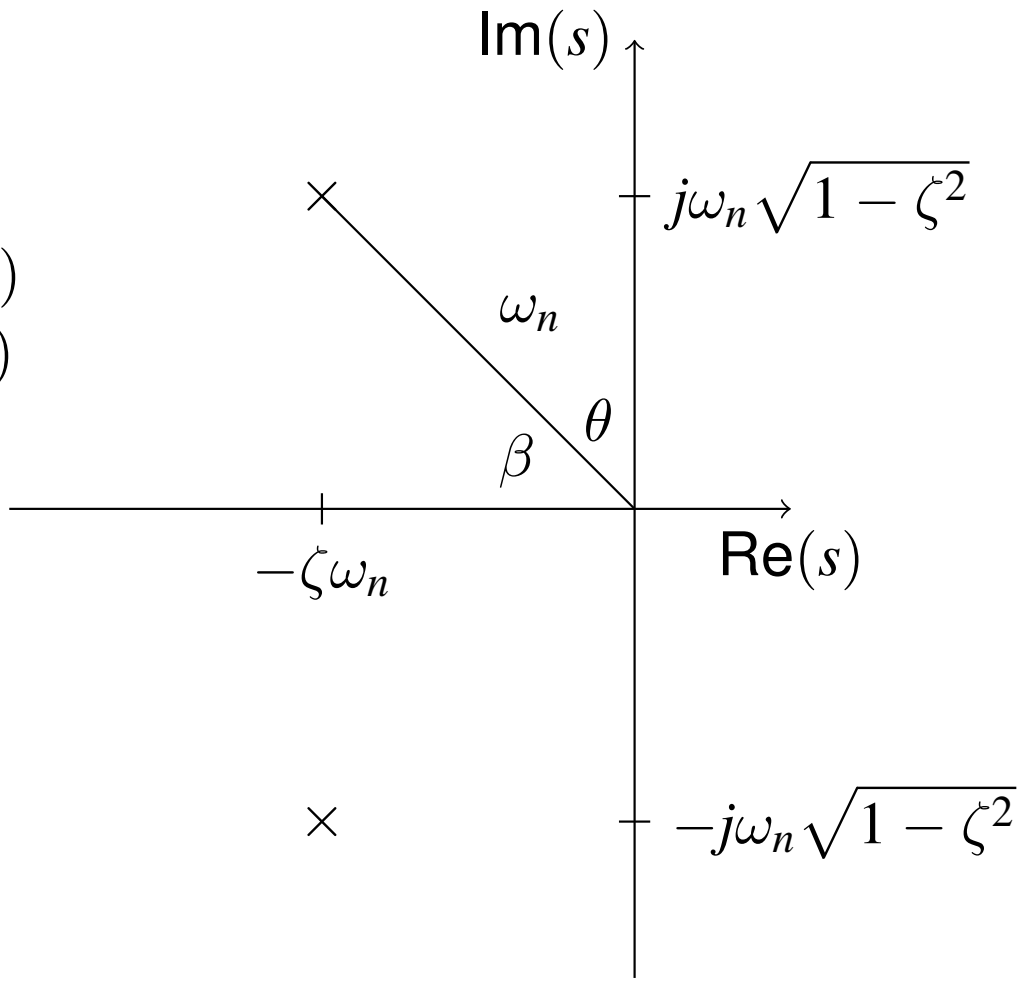
Department of Electrical Engineering
Colorado School of Mines

Fall 2022

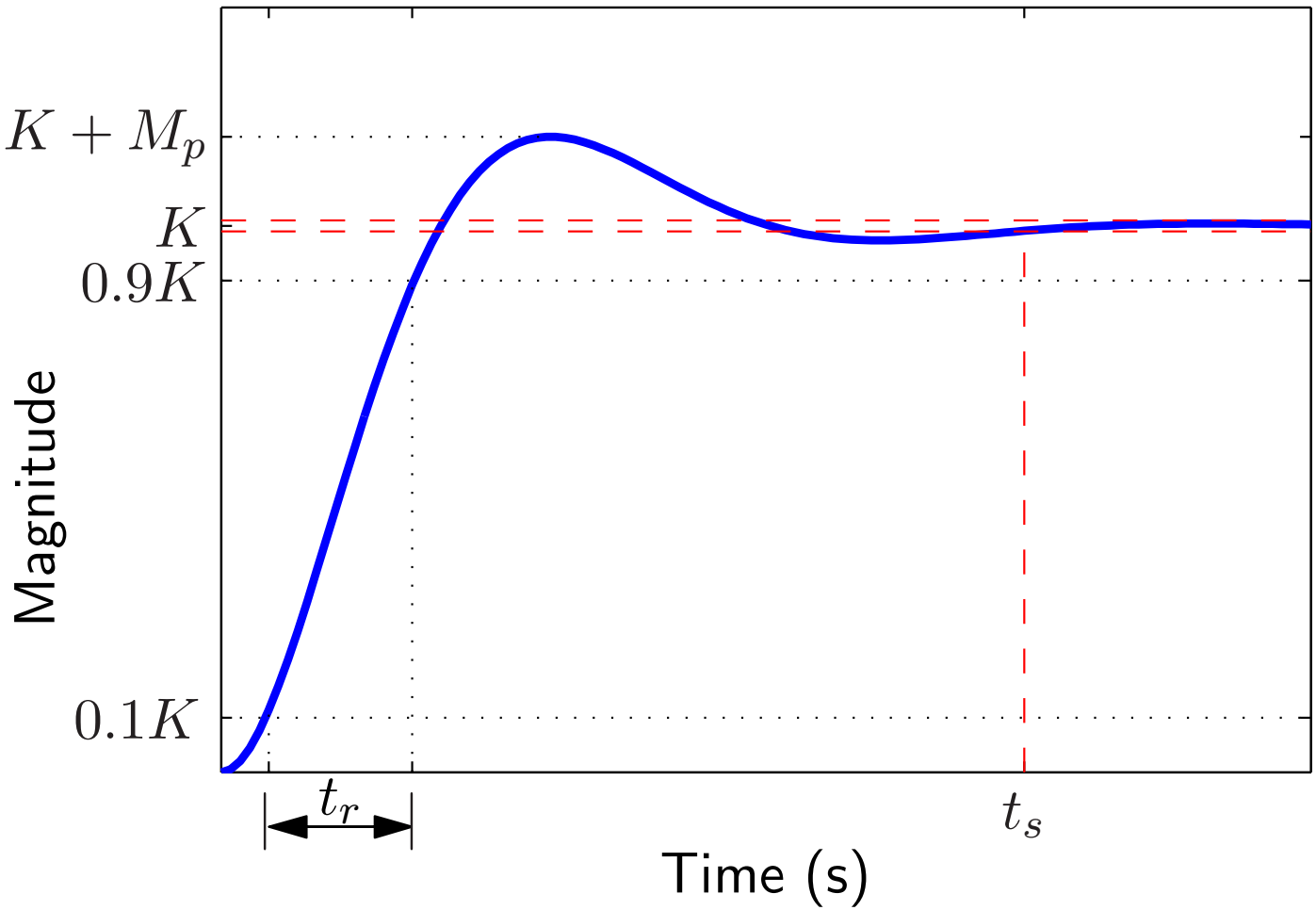
[2] Developed and edited by Tyrone Vincent and Kathryn Johnson, Colorado School of Mines, with contributions from Salman Mohagheghi, Chris Coulston, Kevin Moore, CSM and Matt Kupilik, University of Alaska, Anchorage

Under-damped poles in complex plane

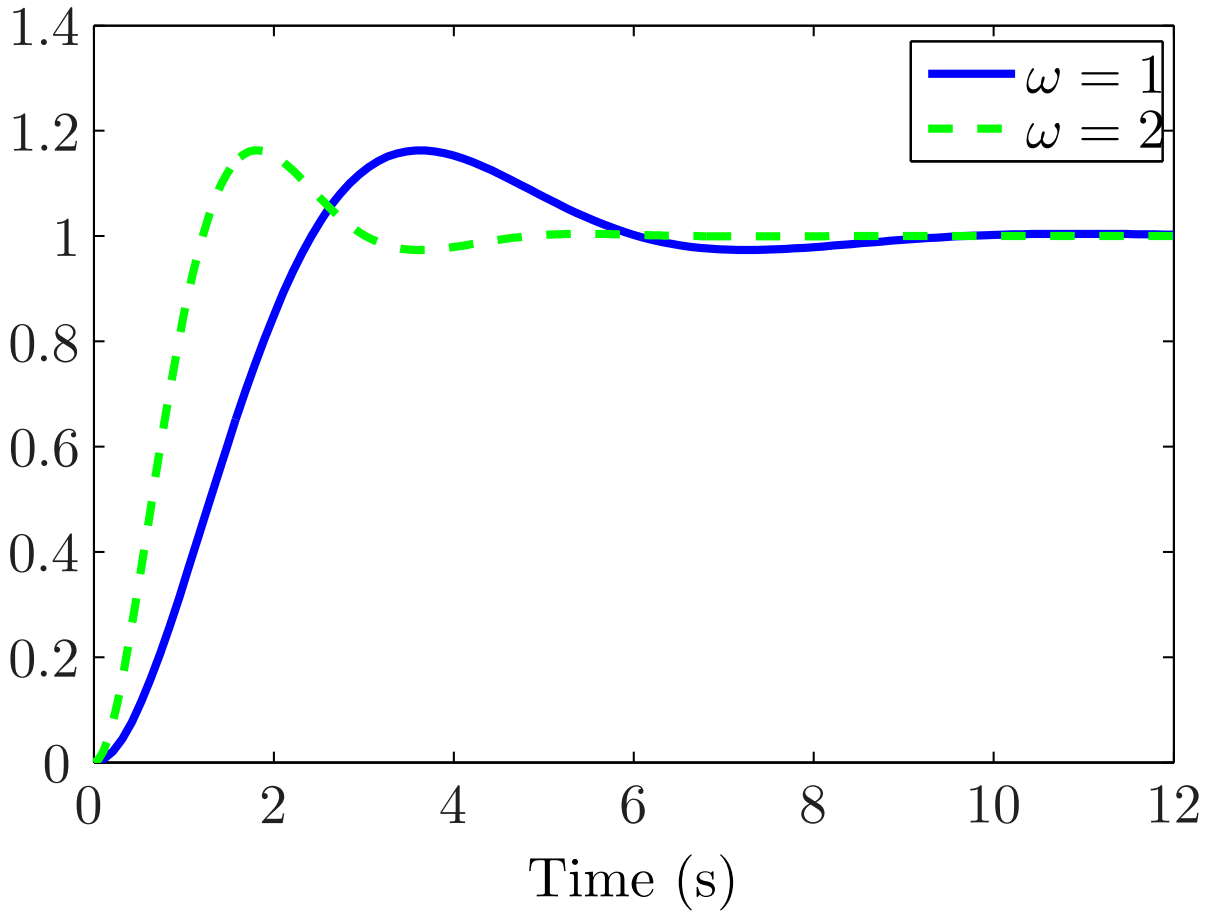
$$\beta = \cos^{-1}(\zeta)$$
$$\theta = \sin^{-1}(\zeta)$$



Second Order Step Response Specifications



Step Response with Varying ω_n



Equation for step response

$$y(t) = K - Ke^{-\zeta(\omega_n t)} \left[\cos(\sqrt{1-\zeta^2}(\omega_n t)) + \frac{\zeta}{\sqrt{1-\zeta^2}} \sin(\sqrt{1-\zeta^2}(\omega_n t)) \right]$$

Step Response in Normalized Time