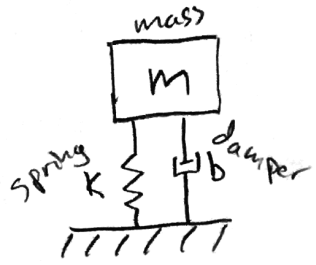
SISO Control: 2nd-Order System

Dec 9, 2017



$m\ddot{x} + b\dot{x} + kx = 0$ Dynamics...

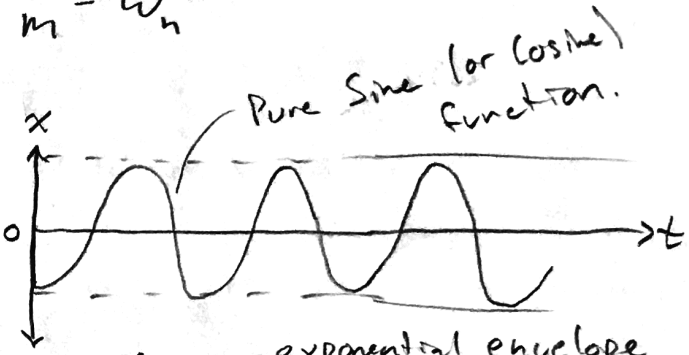
↓ [show Eqn. Below]

$\ddot{x} + 2\zeta\omega_n\dot{x} + \omega_n^2 x = 0$ Control!

Match Coeff: $\frac{b}{m} = 2\zeta\omega_n$ $\frac{k}{m} = \omega_n^2$

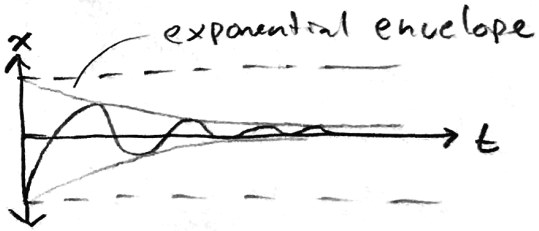
Behavior:

$b = 0 \rightarrow \zeta = 0$ un-damped



$b^2 - 4mk < 0$ under-damped

$0 < \zeta < 1$



* where does ζ come from?

↳ Determinant of the system!

$ms^2 + bs + k = 0$ characteristic eqn

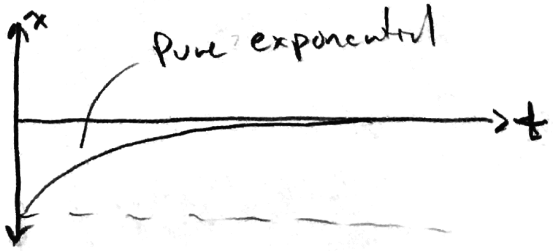
↳ $s = -\frac{b}{2m} \pm \frac{\sqrt{b^2 - 4mk}}{2m}$

$b^2 - 4mk = 0$

$\zeta = 1$

Critically Damped

$s = -\frac{b}{2m}$



$b^2 - 4mk > 0$

$\zeta > 1$

Over-Damped

- Two Real Roots