

$$x'' + 2\gamma y' + \omega_0^2 y = 0$$

$$x'' + 2(\underbrace{\gamma \omega_n}_{\uparrow P = \gamma \omega_n})x' + \underbrace{\omega_0^2}_{\uparrow \omega_0^2 = \omega_n^2} x = 0$$

$$\ddot{x} + 2\gamma \omega_n \dot{x} + \omega_n^2 x = 0$$

$$\ddot{x} + 2$$

$$P = \gamma \omega_n$$

$$P^2 = \gamma^2 \omega_n^2$$

$$\omega_n^2 < \frac{\gamma^2 \omega_n^2}{\omega_n^2}$$

$$1 < \gamma^2$$

overdamped

$$1 < \gamma^2$$

underdamped:

$$1 > \gamma^2$$

critically damped

$$1 = \gamma^2$$