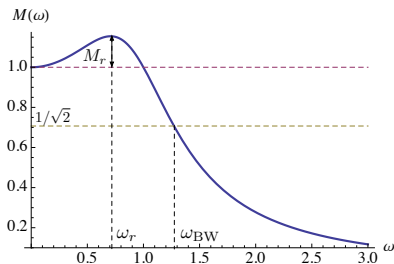


Frequency Response Parameters



We can get the following formulas using calculus:

$$\begin{cases} \omega_r = \omega_n \sqrt{1 - 2\zeta^2} \\ M_r = \frac{1}{2\zeta\sqrt{1 - \zeta^2}} - 1 \end{cases} \quad (\text{valid for } \zeta < \frac{1}{\sqrt{2}}; \text{ for } \zeta \geq \frac{1}{\sqrt{2}}, \omega_r = 0)$$

$$\omega_{BW} = \omega_n \underbrace{\sqrt{(1 - 2\zeta^2) + \sqrt{(1 - 2\zeta^2)^2 + 1}}}_{=1 \text{ for } \zeta=1/\sqrt{2}}$$

— so, if we know $\omega_r, M_r, \omega_{BW}$, we can determine ω_n, ζ and hence the time-domain specs (t_r, M_p, t_s)