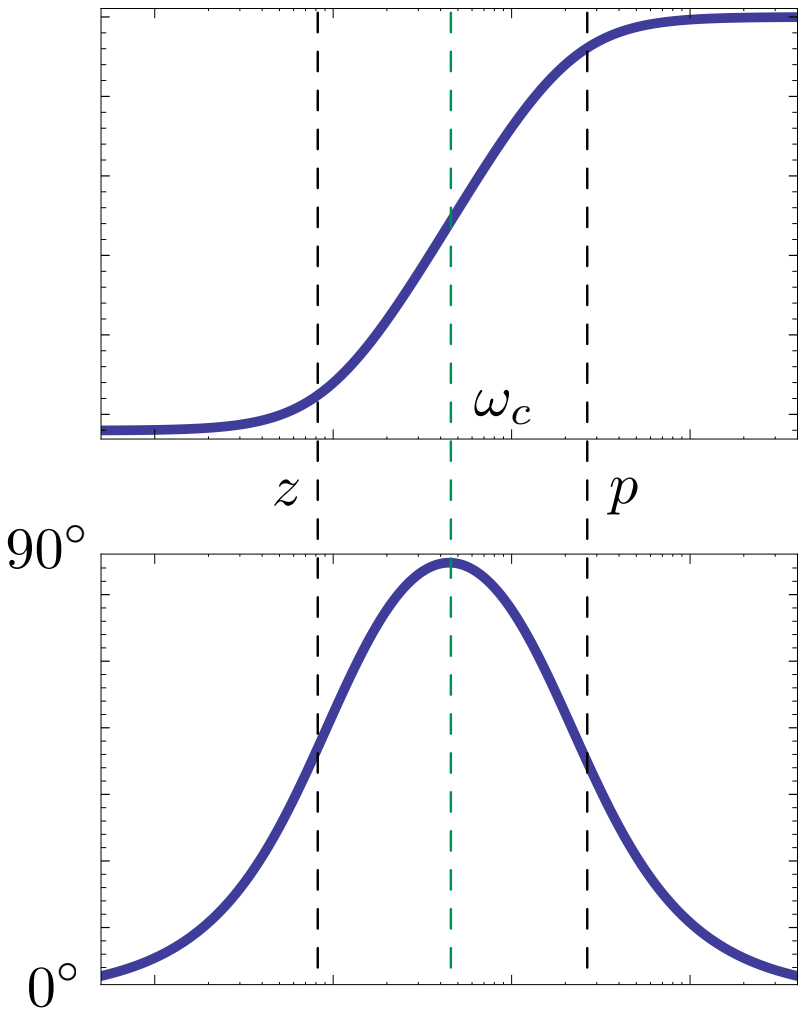
Lead Compensation and Phase Margin

$$KD(s) = \frac{K\left(\frac{s}{z}+1\right)}{\left(\frac{s}{p}+1\right)}$$



For best effect on PM, ω_c should be halfway between z and p (on log scale):

$$\log \omega_c = \frac{\log z + \log p}{2}$$

$$\text{or } \omega_c = \sqrt{z \cdot p}$$

— geometric mean of z and p

Trade-offs: large $p - z$ means

- large PM (closer to 90°)
- but also bigger M at higher frequencies (worse noise suppression)