

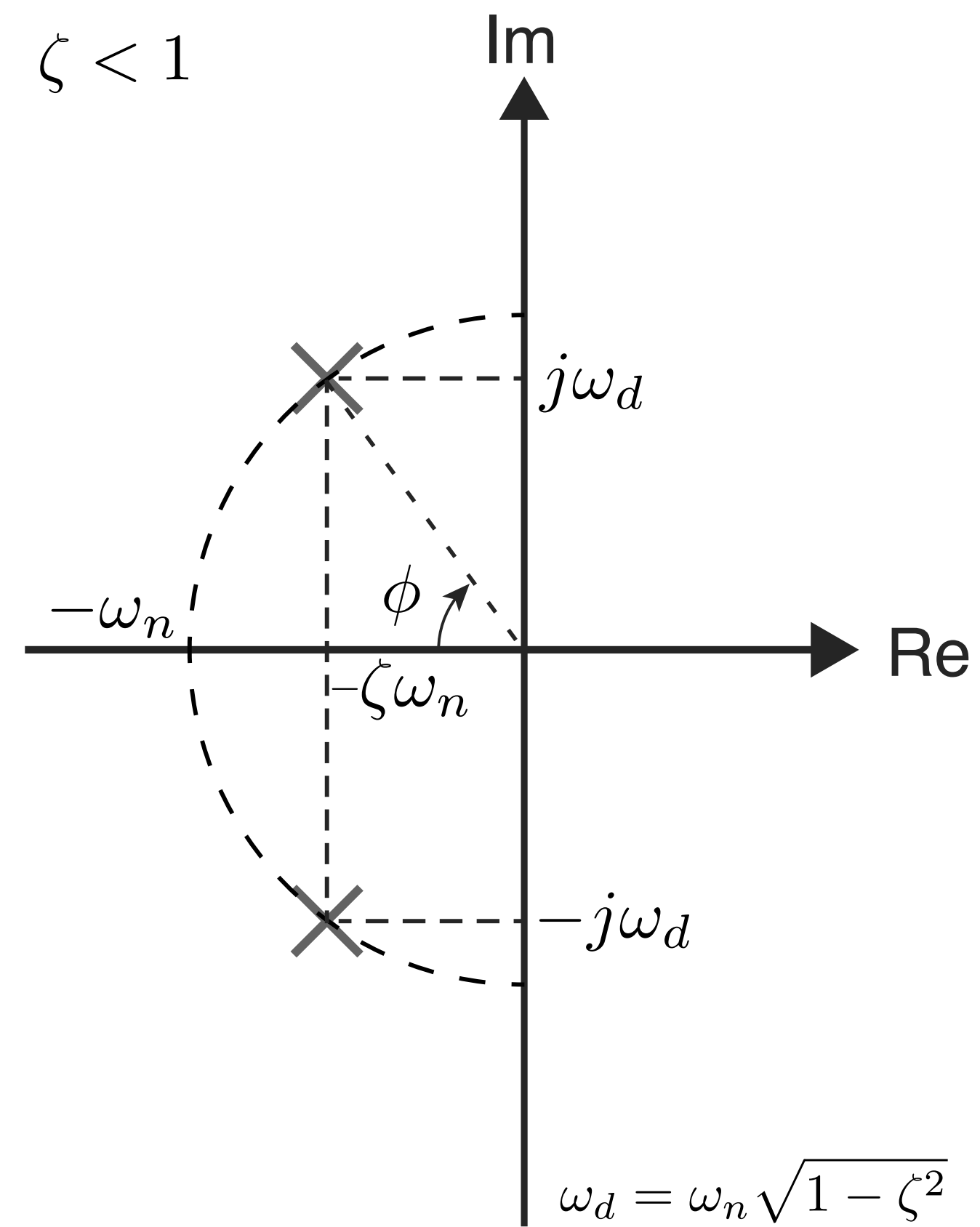
$$y(t) = 1 - \frac{e^{-\zeta\omega_n t}}{\sqrt{1 - \zeta^2}} \sin(\omega_d t + \phi)$$

$$\tan \phi = \frac{\sqrt{1 - \zeta^2}}{\zeta}$$

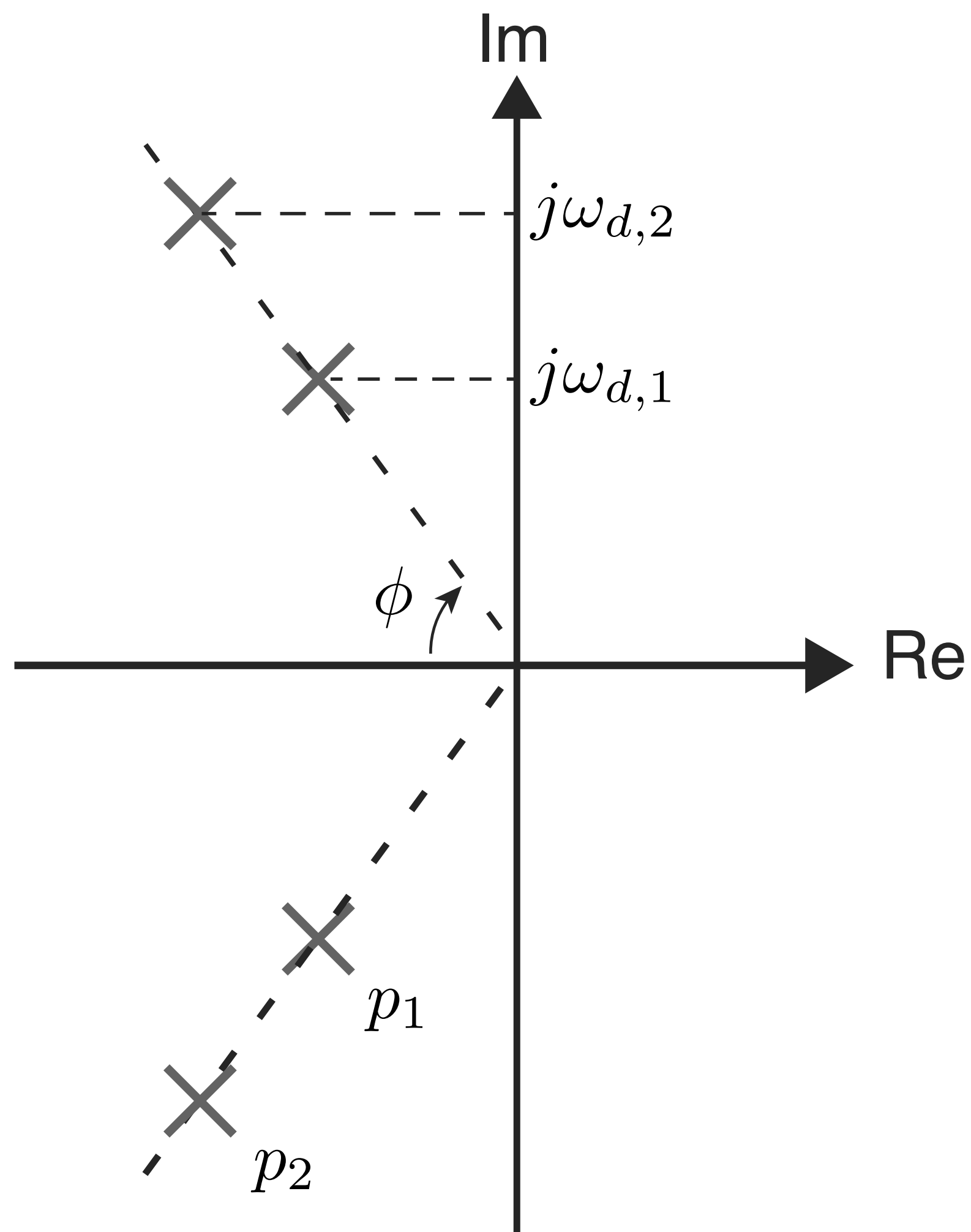
$$M_p = e^{-\pi \frac{\zeta}{\sqrt{1-\zeta^2}}} = e^{-\pi/\tan \phi}$$

$$t_s = \frac{4}{\zeta \omega_n} \quad t_p = \frac{\pi}{\omega_d}$$

$$t_r = \frac{\pi - \phi}{\omega_d}$$



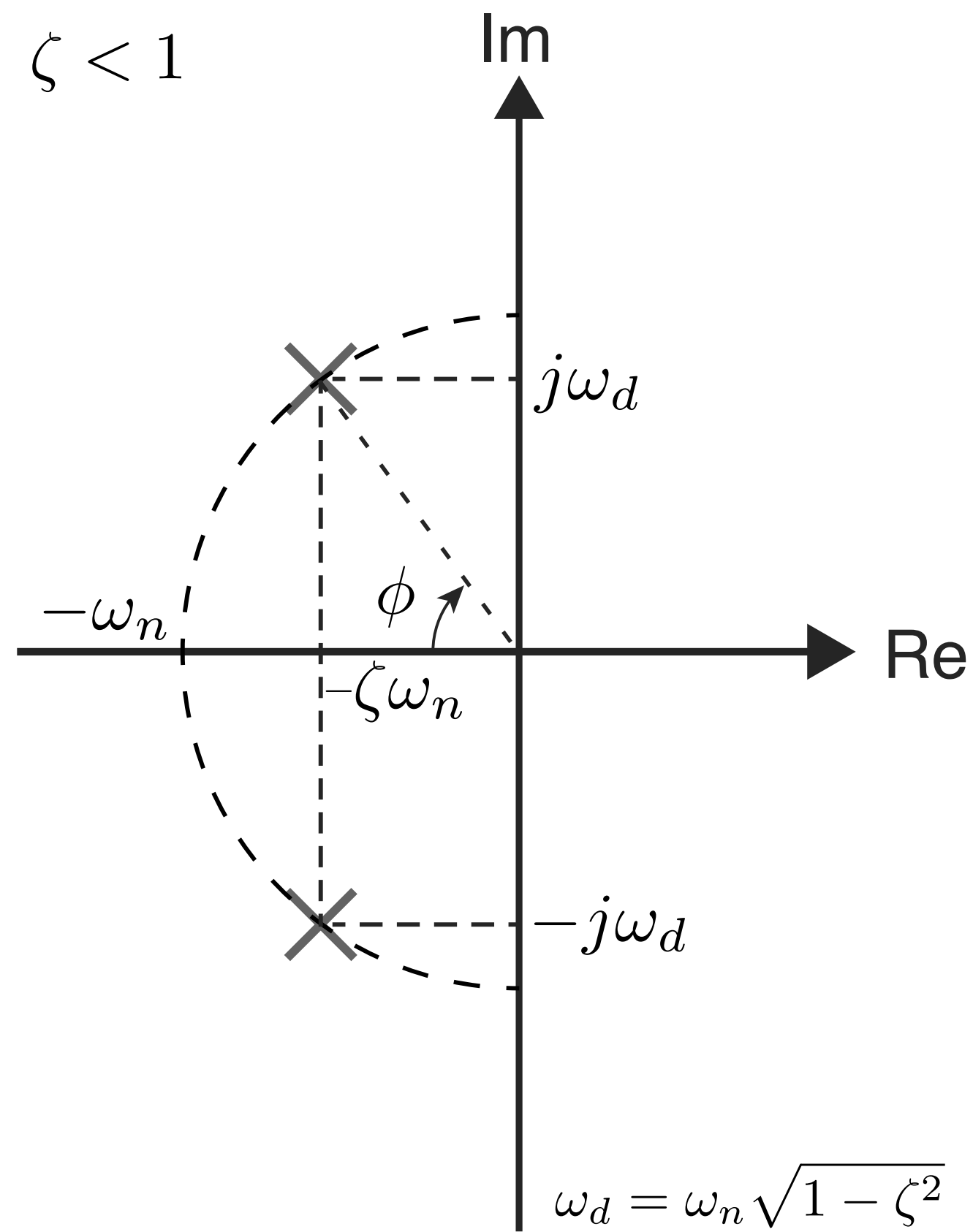
Constant ϕ, ζ



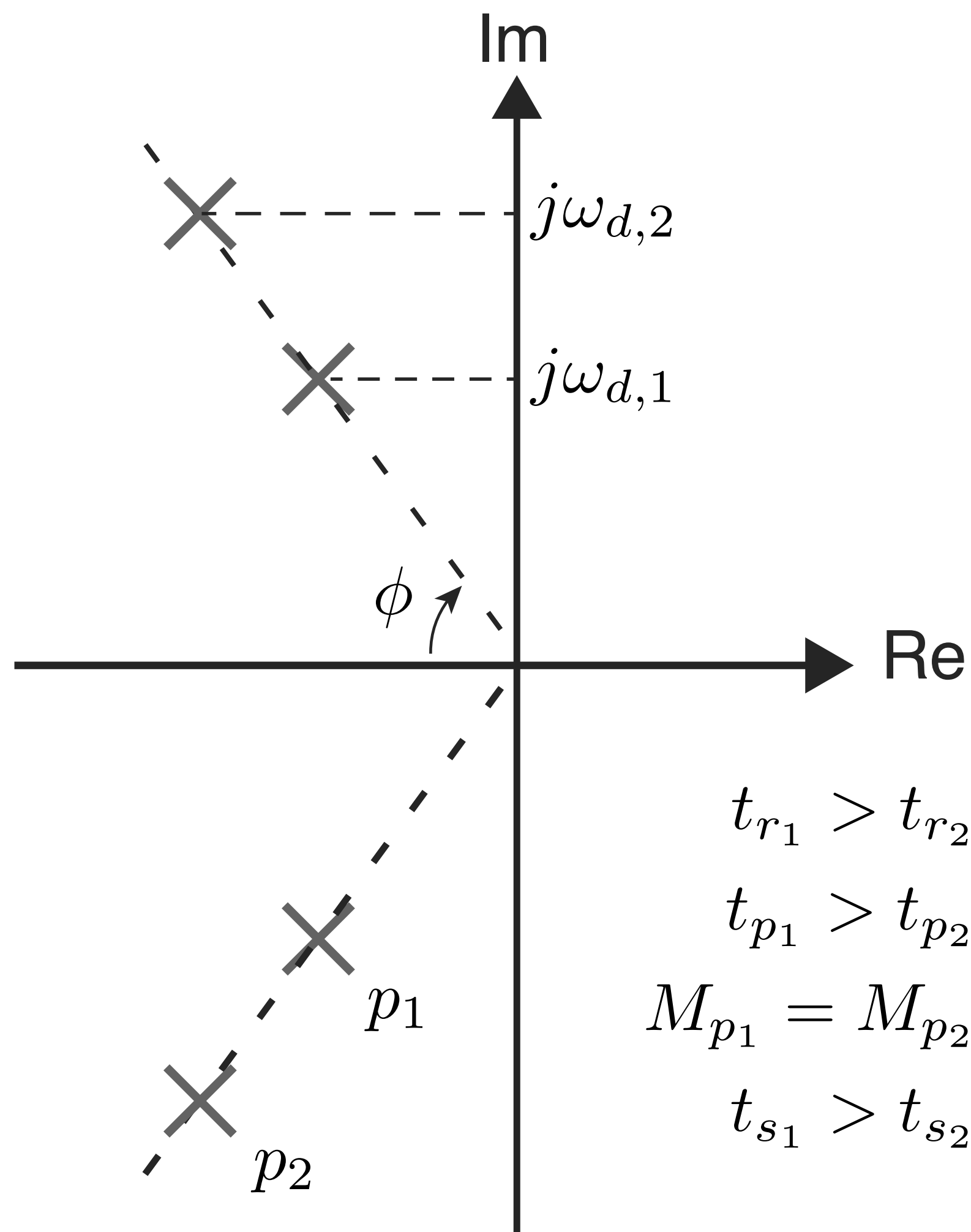
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Constant ϕ, ζ



$$t_{r_1} > t_{r_2}$$

$$t_{p_1} > t_{p_2}$$

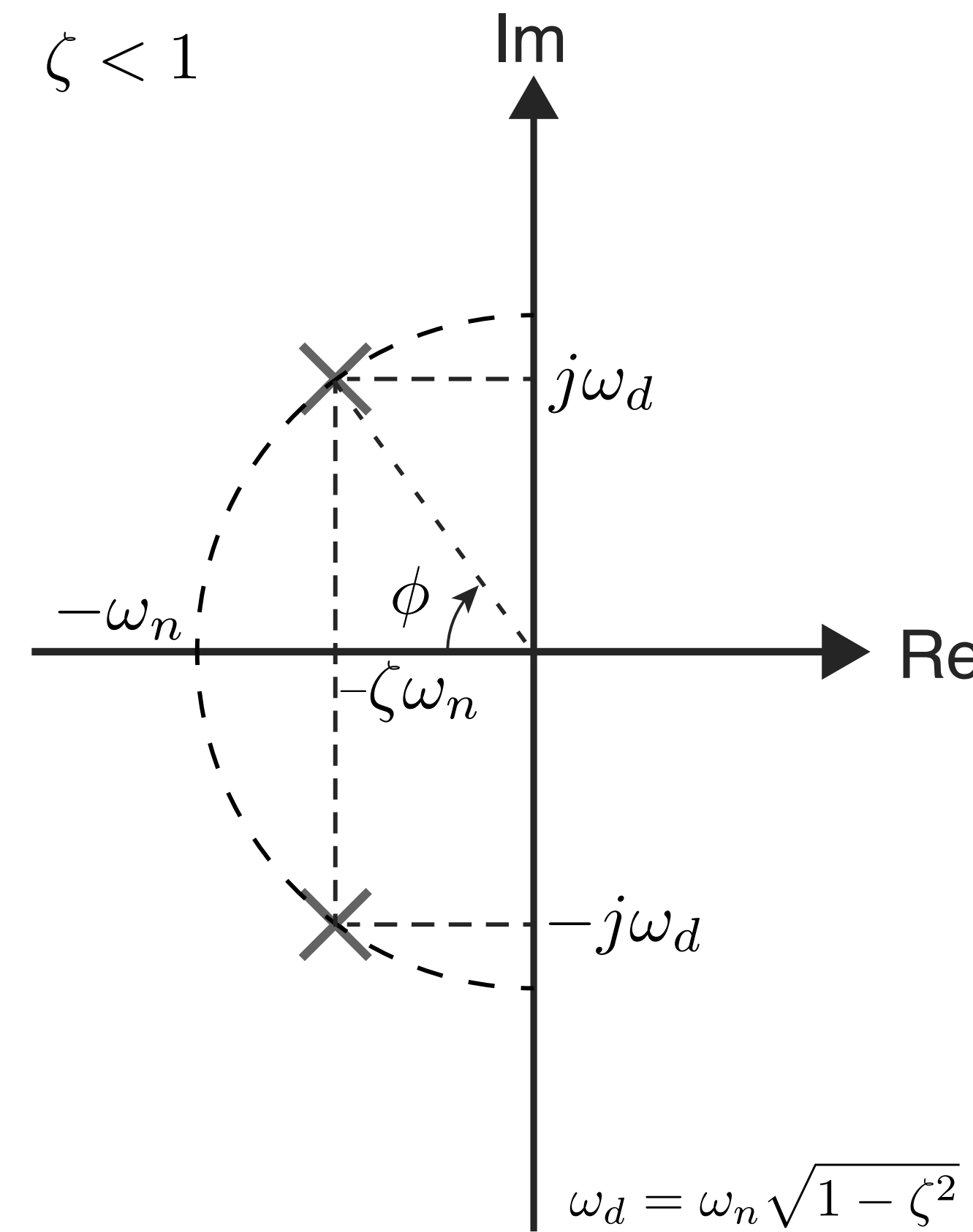
$$M_{p_1} = M_{p_2}$$

$$t_{s_1} > t_{s_2}$$

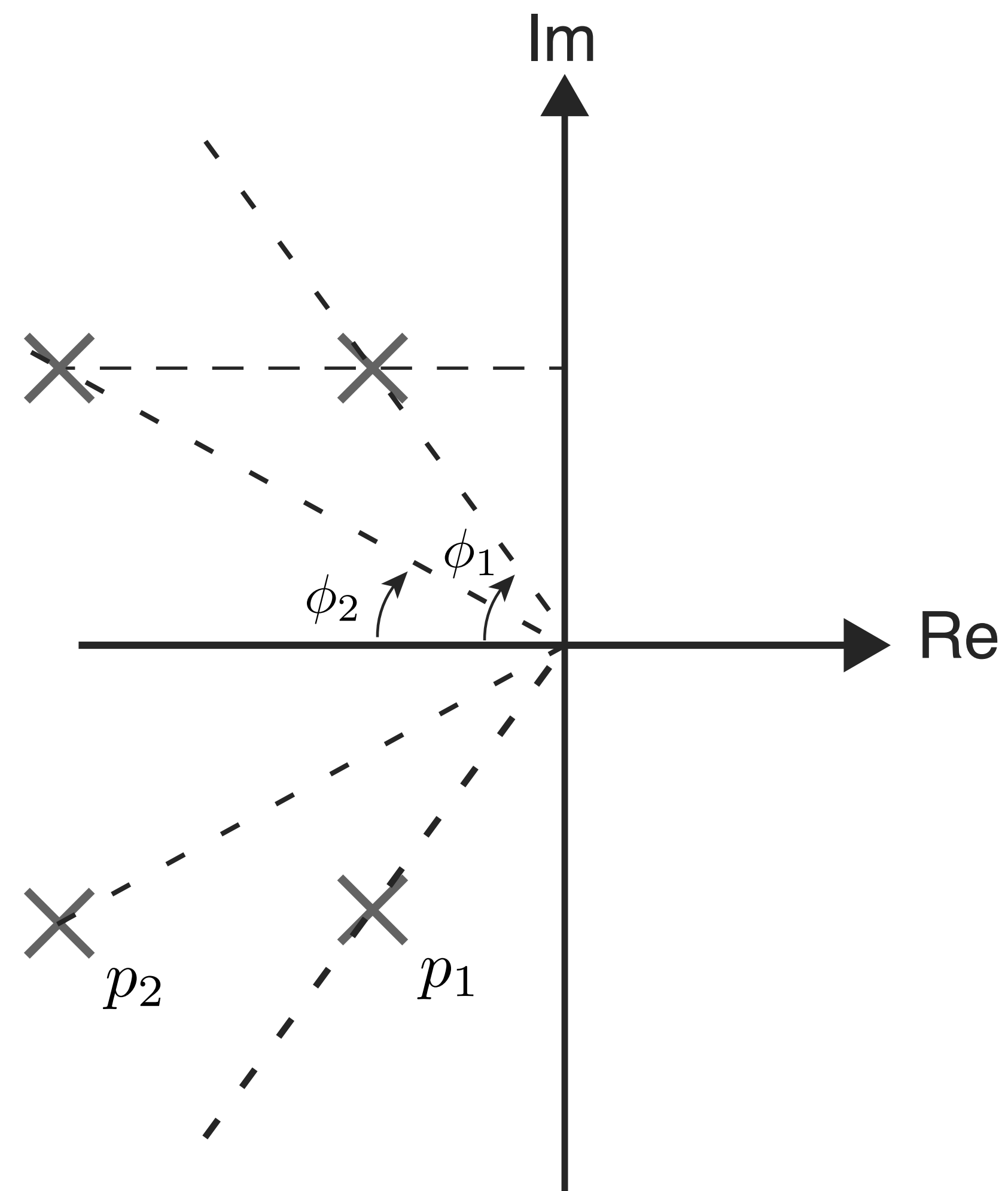
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Constant ω_d

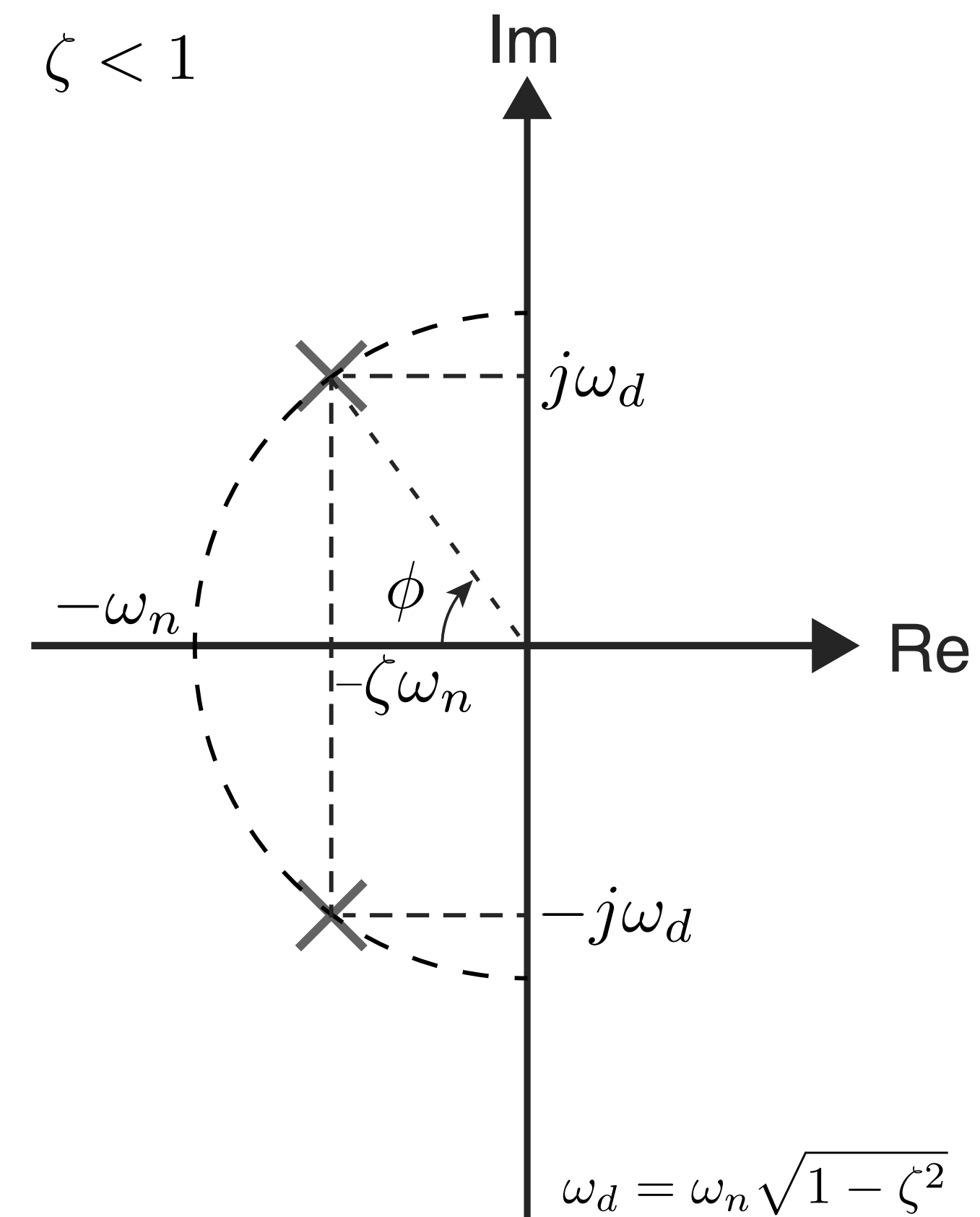


$$M_p = e^{-\pi \frac{\zeta}{\sqrt{1-\zeta^2}}} = e^{-\pi/\tan \phi}$$

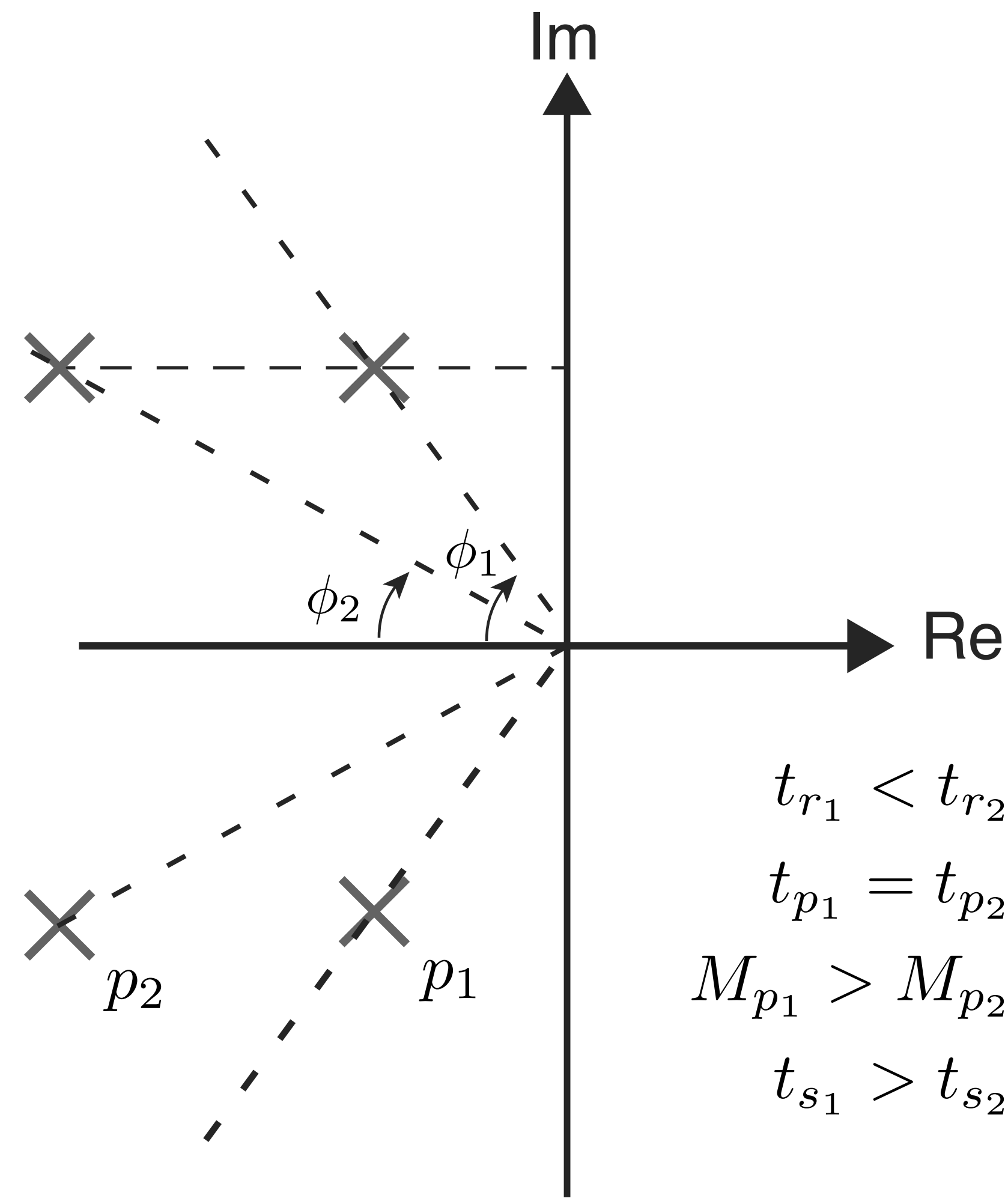
$$t_s = \frac{4}{\zeta \omega_n} \quad t_p = \frac{\pi}{\omega_d}$$

$$t_r = \frac{\pi - \phi}{\omega_d}$$

$\zeta < 1$



Constant ω_d

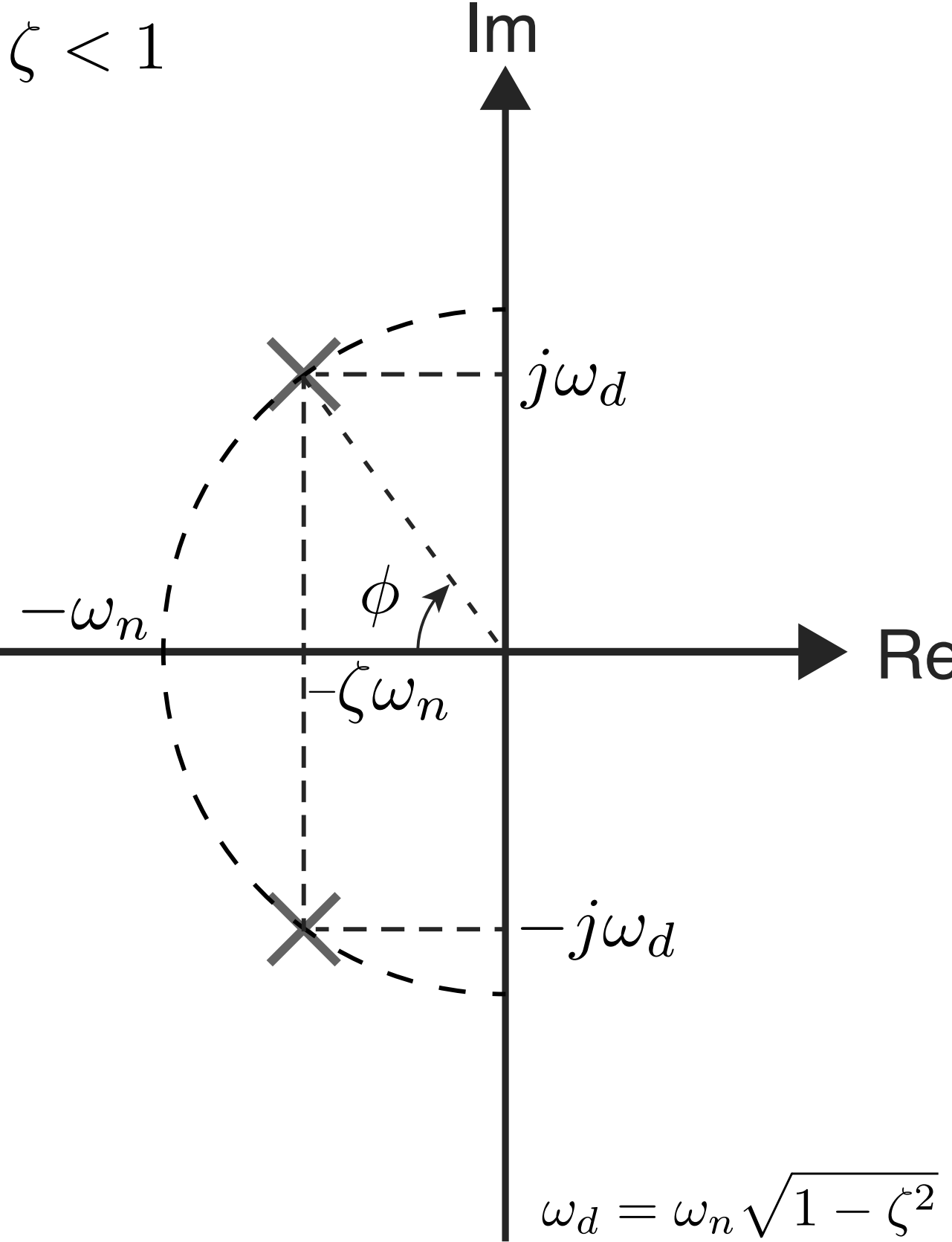


$$\begin{aligned} t_{r_1} &< t_{r_2} \\ t_{p_1} &= t_{p_2} \\ M_{p_1} &> M_{p_2} \\ t_{s_1} &> t_{s_2} \end{aligned}$$

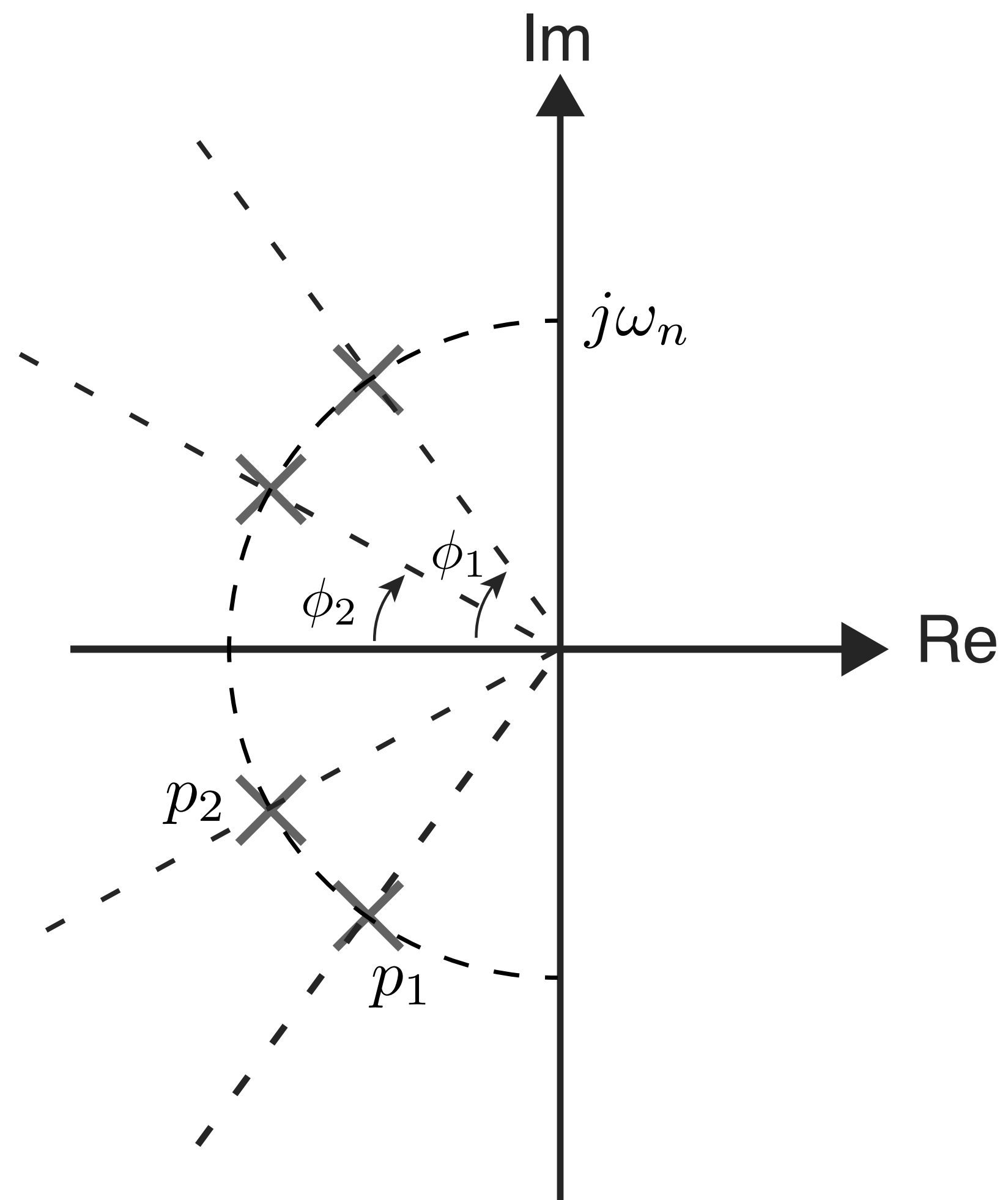
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Constant ω_n

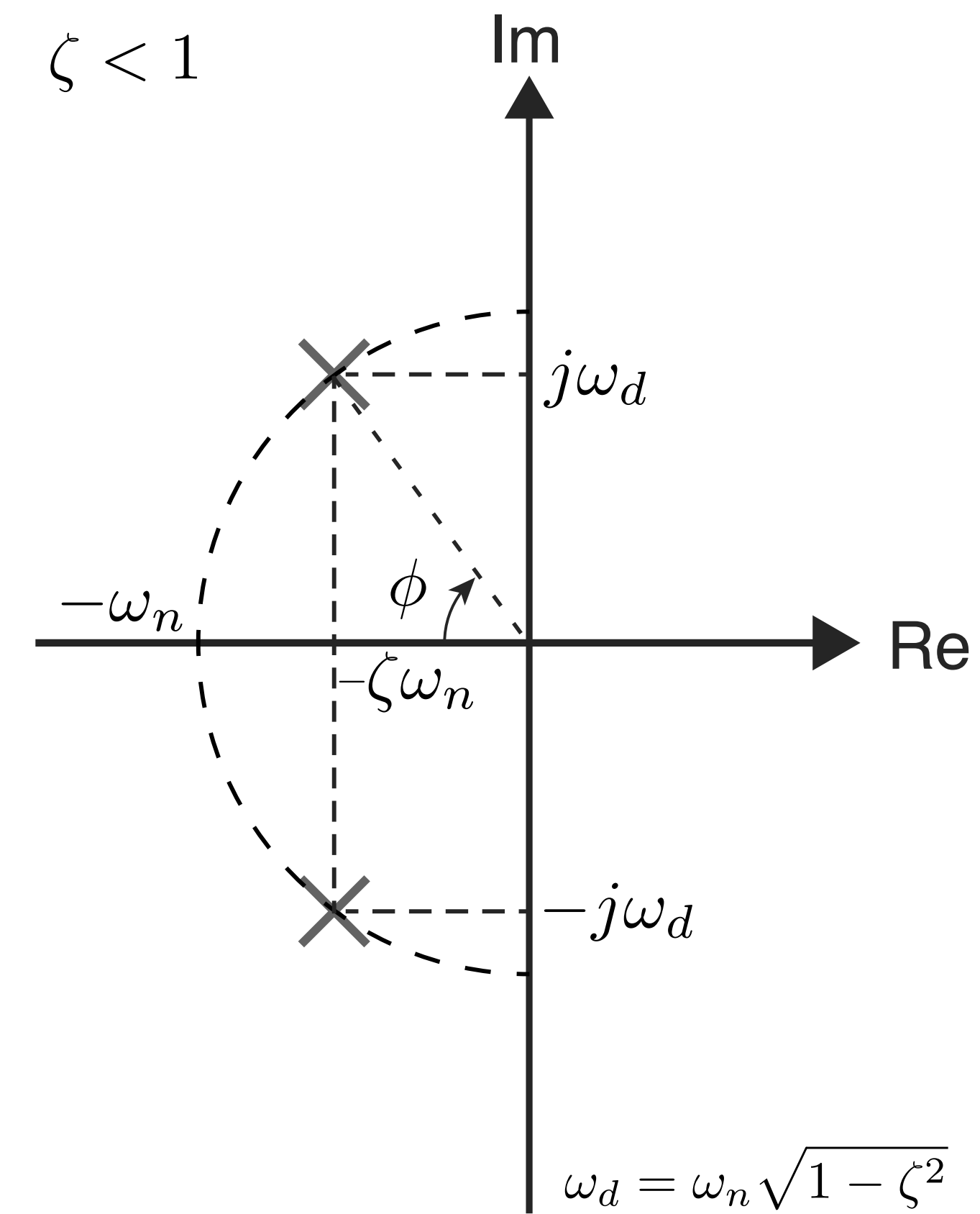


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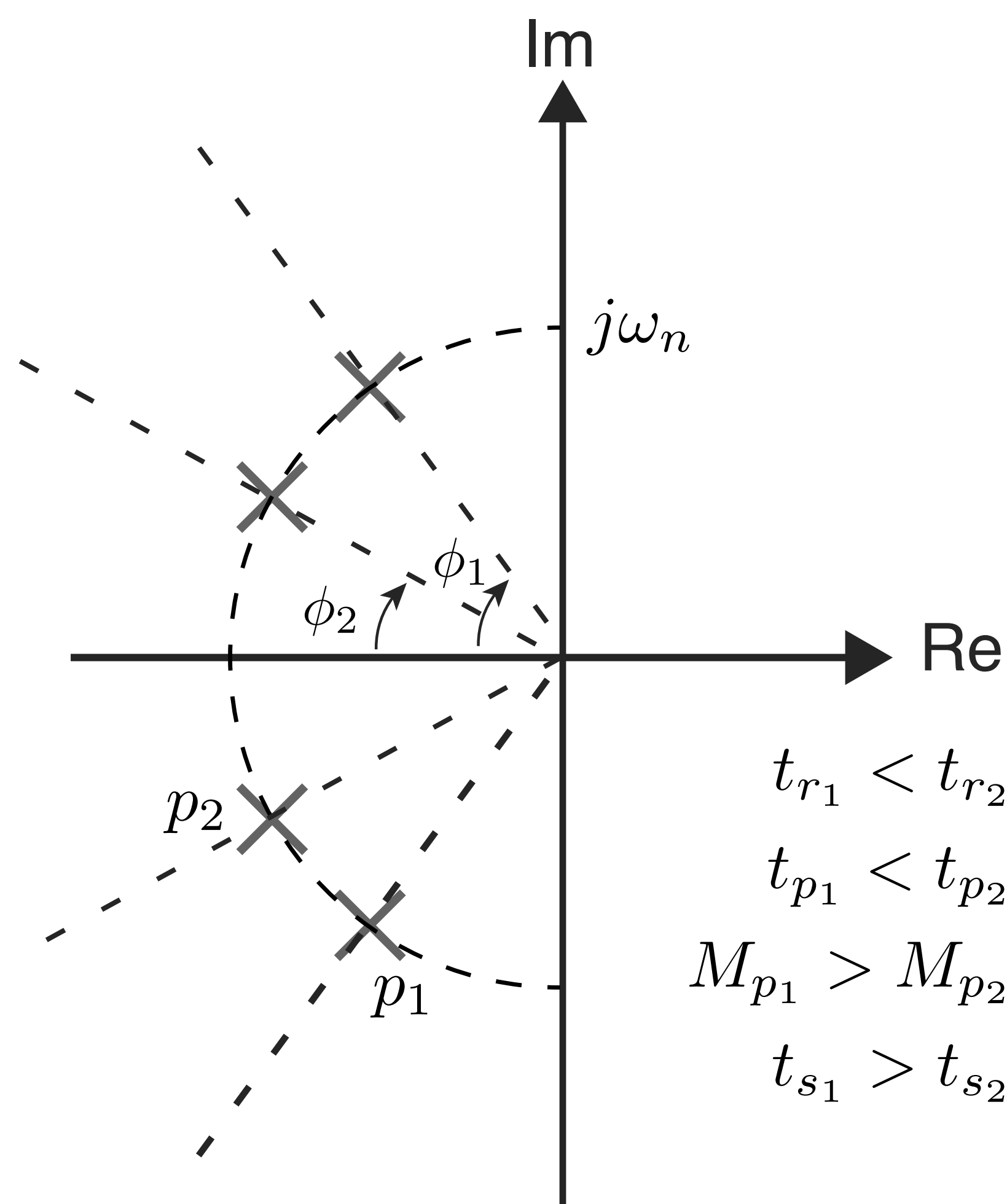
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Constant ω_n

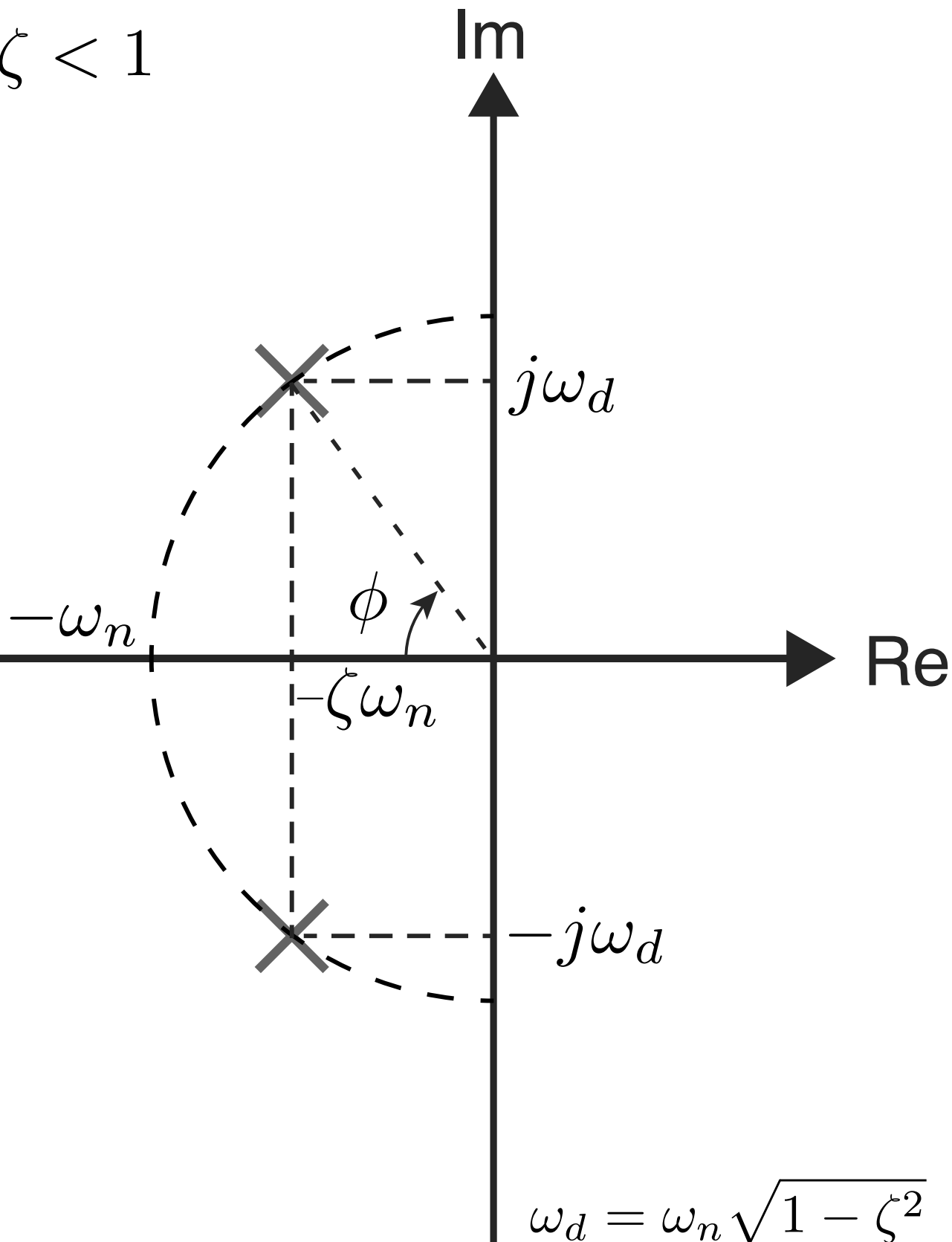


$$\begin{aligned} t_{r1} &< t_{r2} \\ t_{p1} &< t_{p2} \\ M_{p1} &> M_{p2} \\ t_{s1} &> t_{s2} \end{aligned}$$

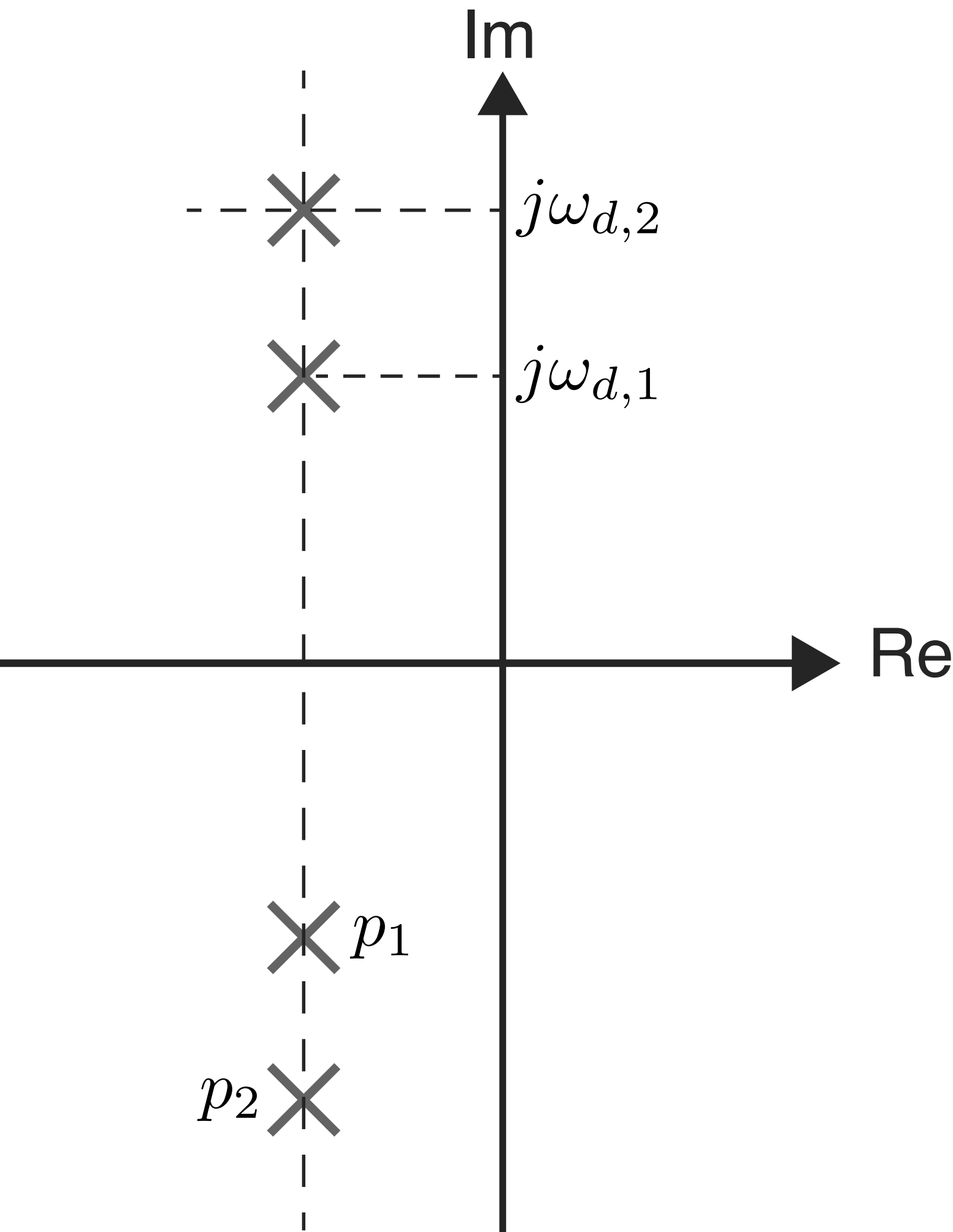
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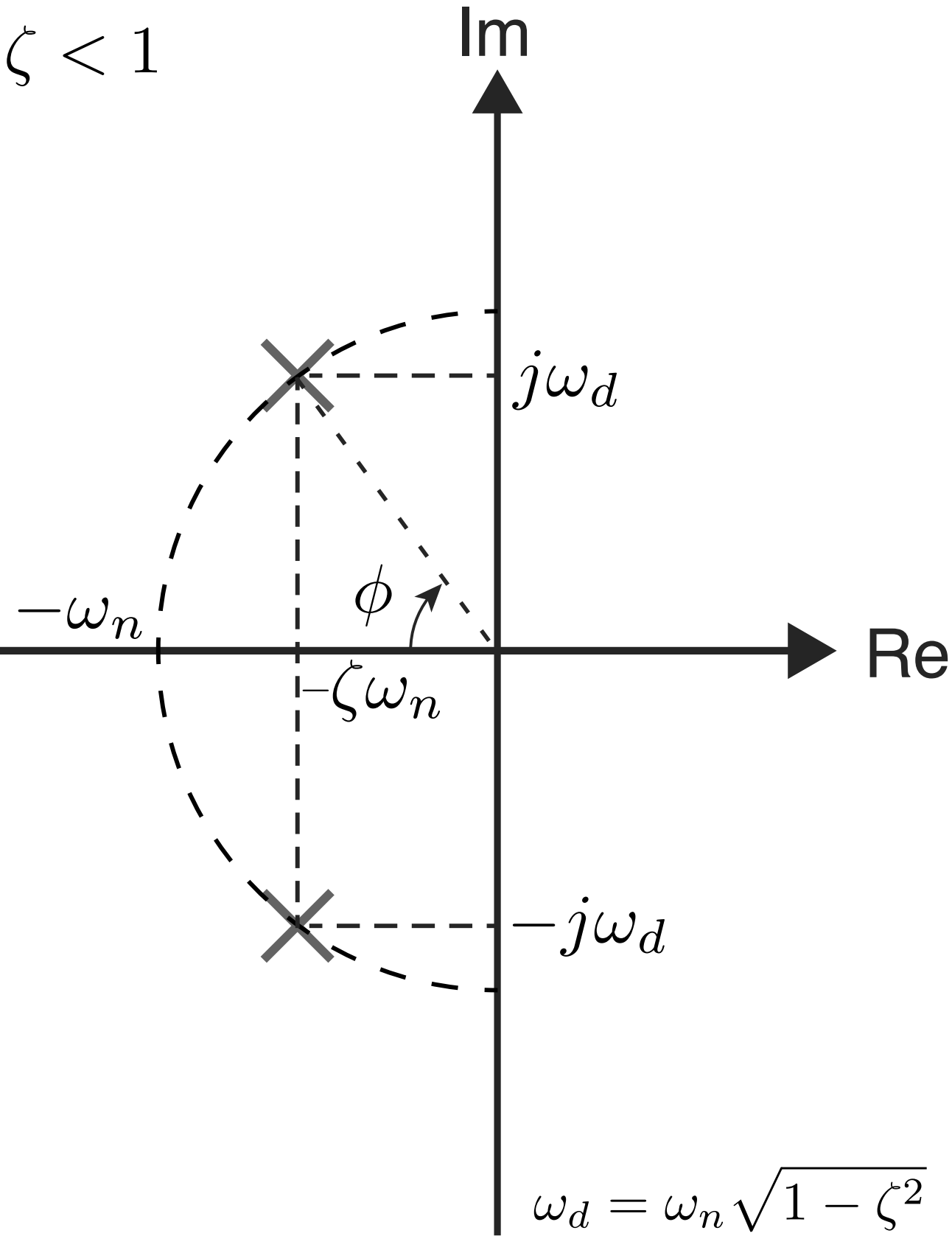
Constant $\sigma = \zeta \omega_n$



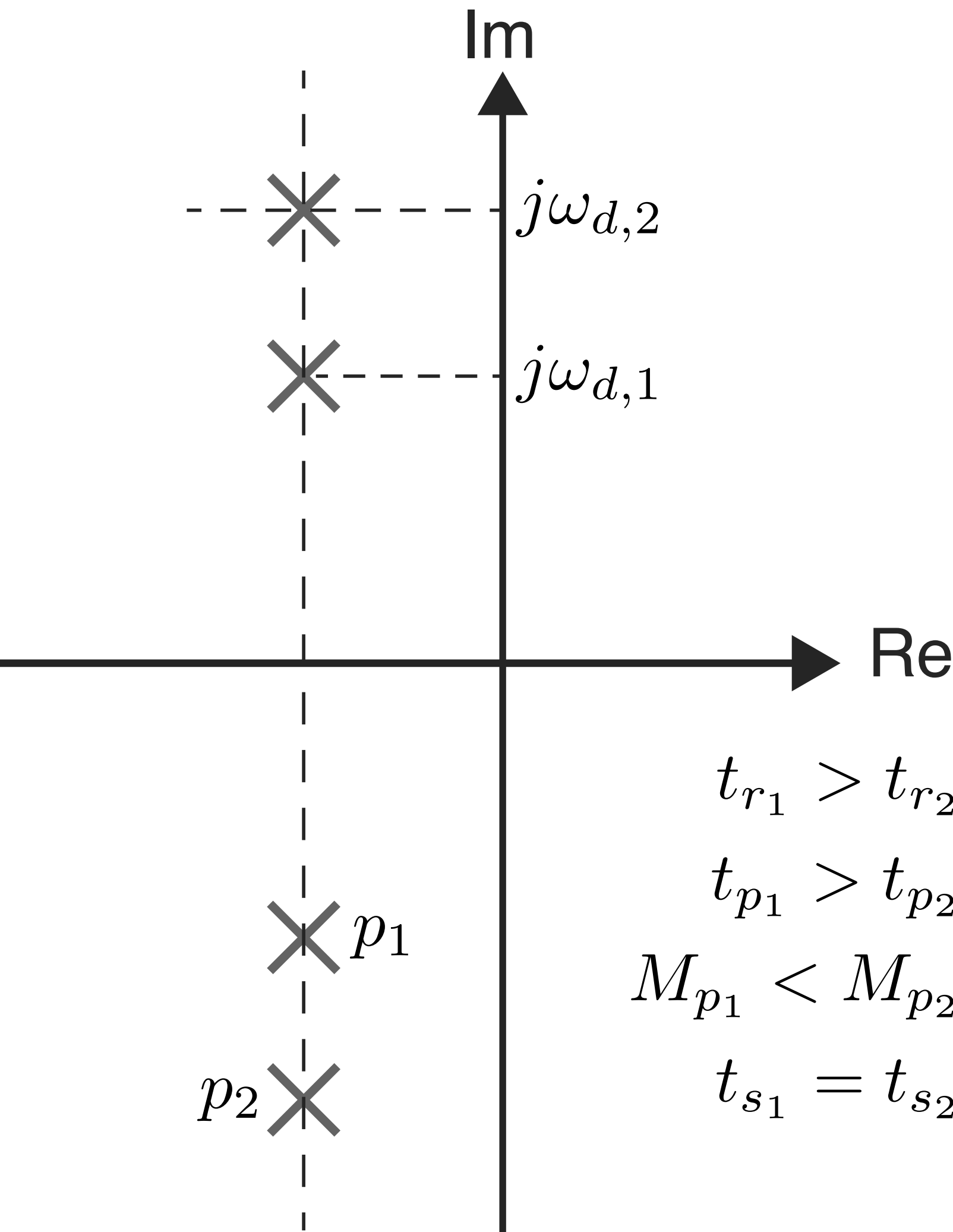
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Constant $\sigma = \zeta\omega_n$

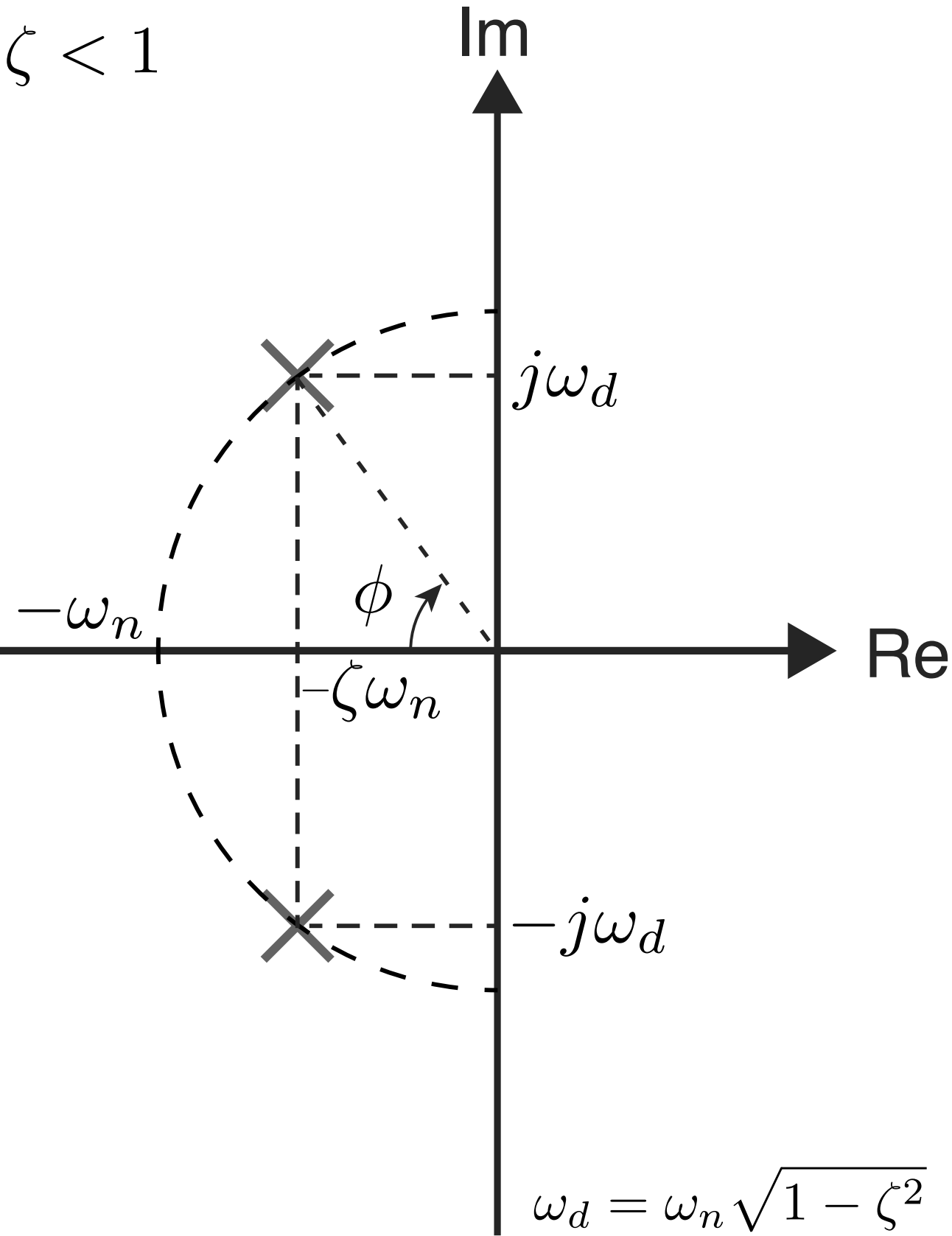


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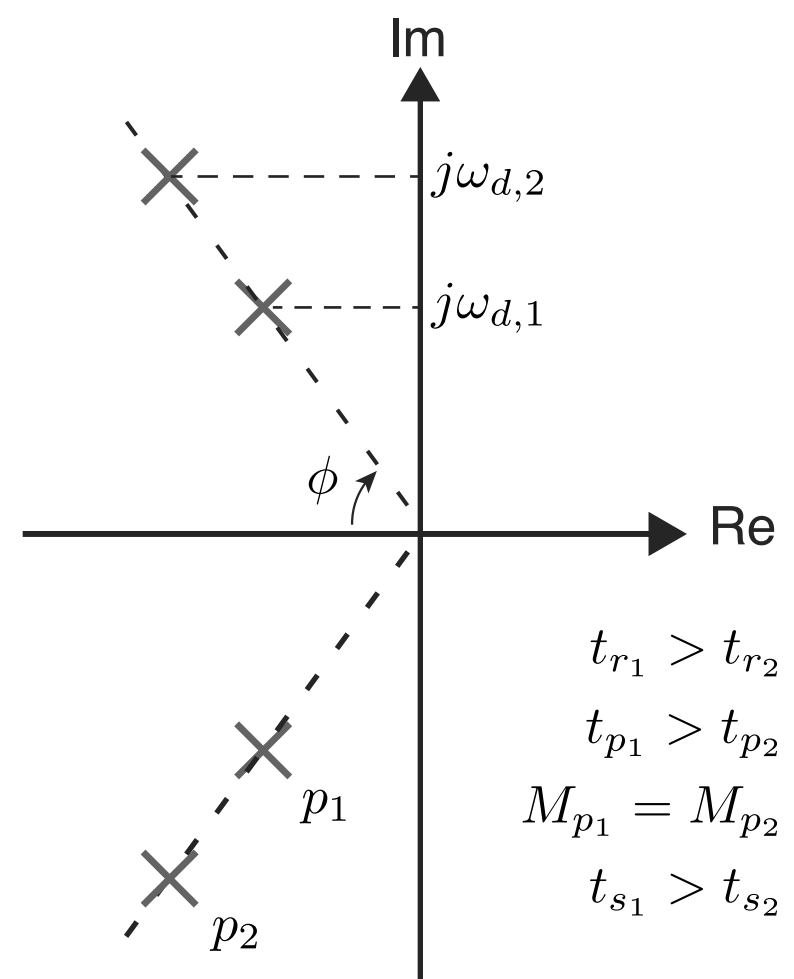
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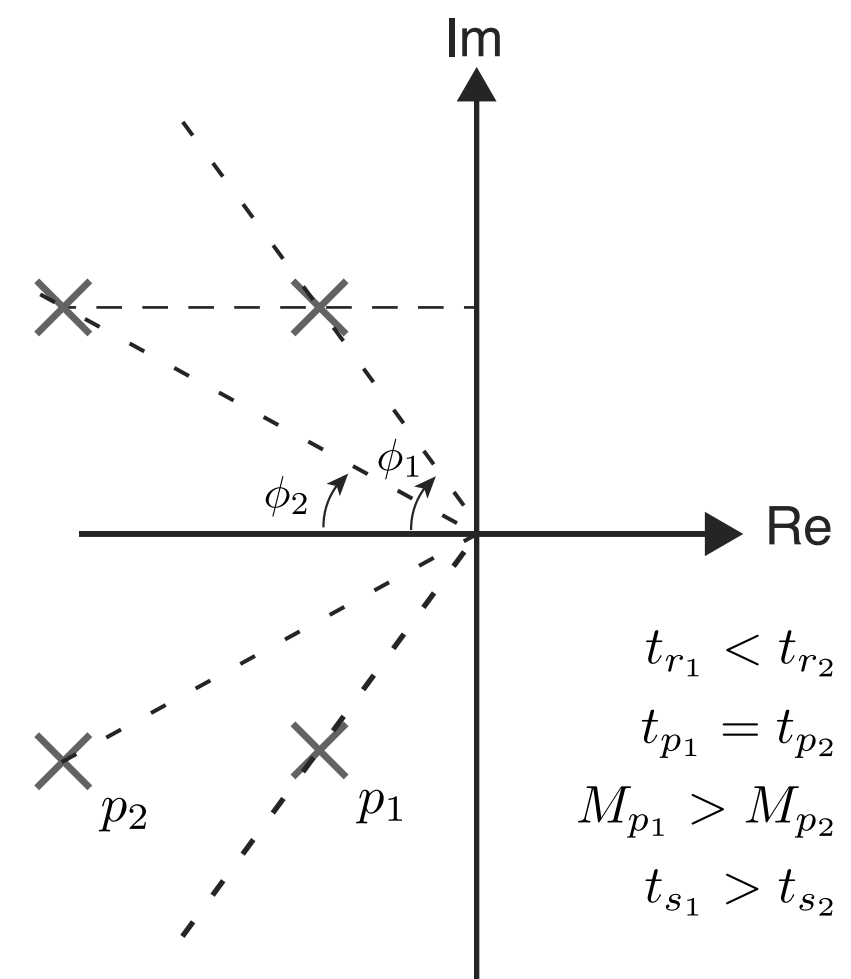
$$t_r = \frac{\pi - \phi}{\omega_d}$$



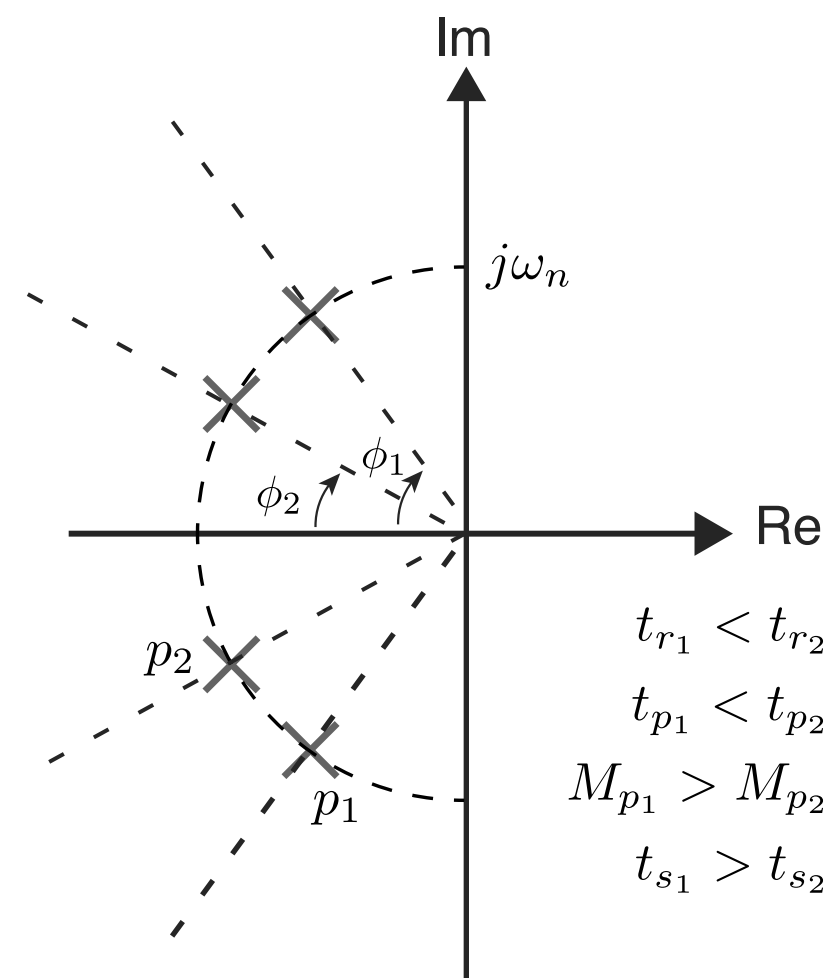
Constant ϕ, ζ



Constant ω_d



Constant ω_n



Constant $\sigma = \zeta\omega_n$

