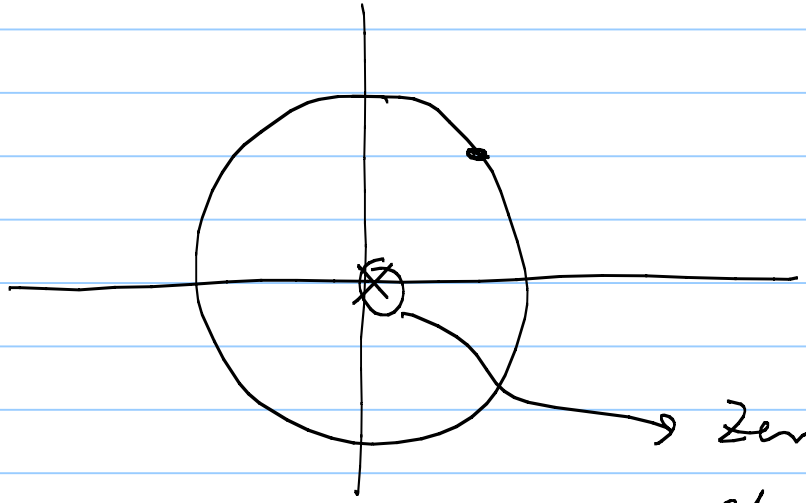
EC 5142 Oct. 24 2011

Note Title 24-10-2011

$$|H(e^{j\Omega})| = |K| \underbrace{|e^{j\omega(N-M)}|}_{\text{trivial pole \& zero}} \frac{\prod_{\ell=1}^{M} |e^{j\omega} - z_\ell|}{\prod_{k=1}^{N} |e^{j\omega} - p_k|}$$



Zero or pole at the origin

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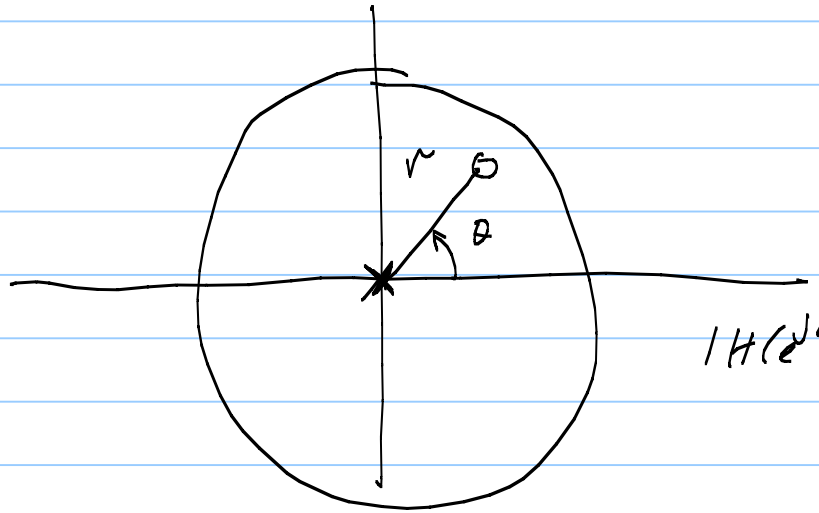
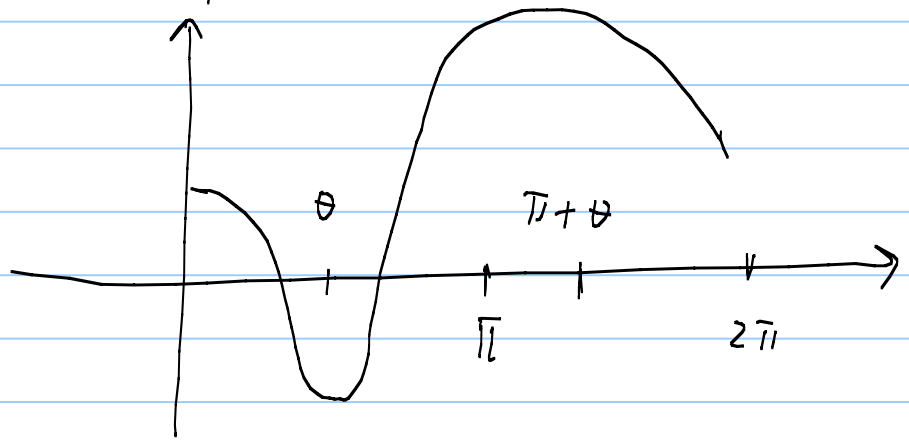


$$H(z) = \frac{1}{1 - re^{j\theta} z^{-1}}$$

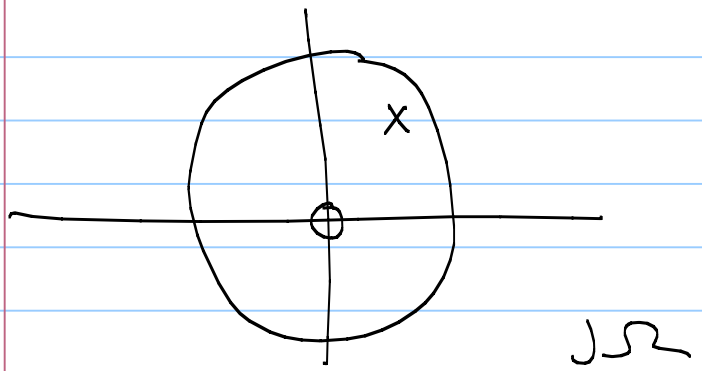
$$= \frac{z}{z - re^{j\theta}}$$

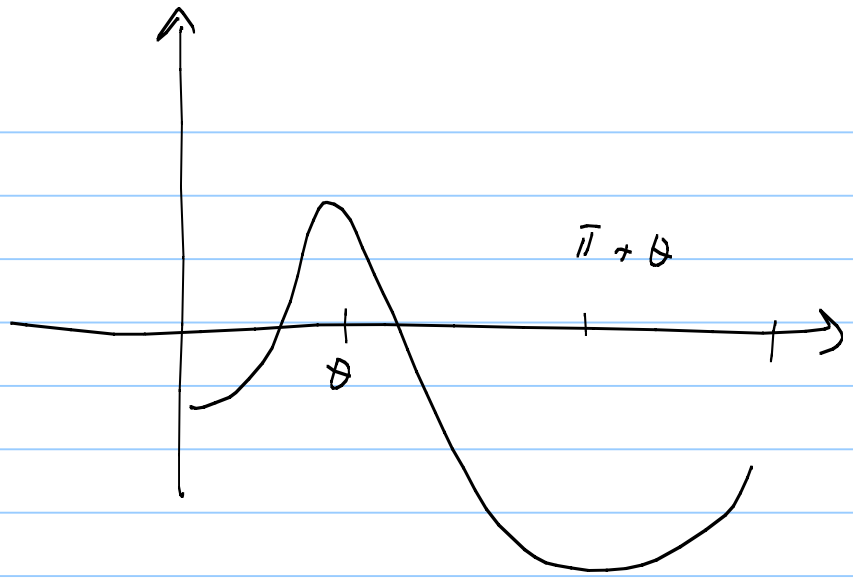
$$1 + r^2 - 2r\cos(\omega - \theta)$$

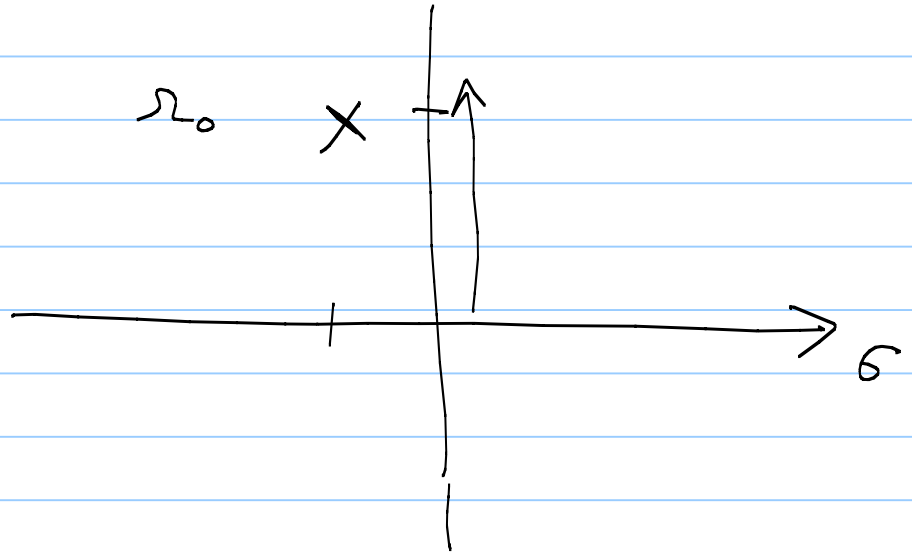


Plot $20 \log_{10} |H(e^{j\omega})|$ or $10 \log_{10} |H(e^{j\omega})|^2$

$$H(z) = \frac{1}{1 - r e^{j\theta} z^{-1}}$$

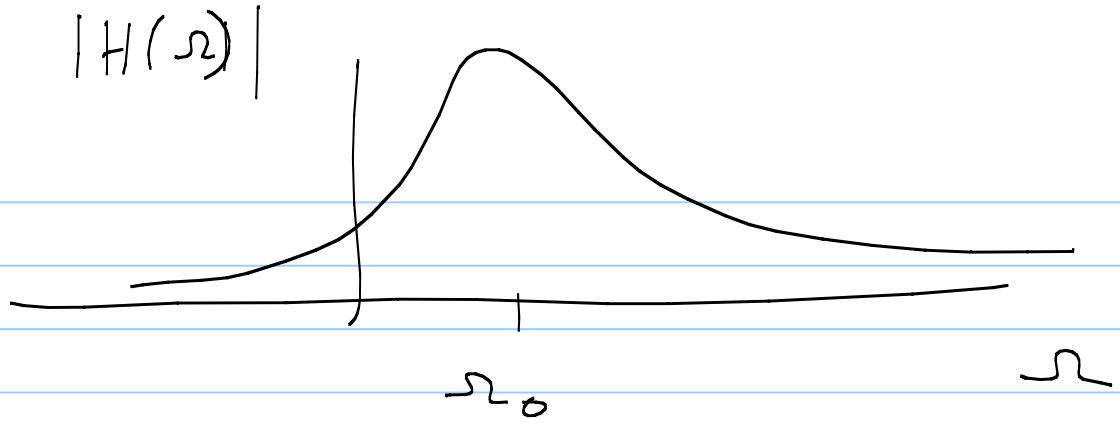


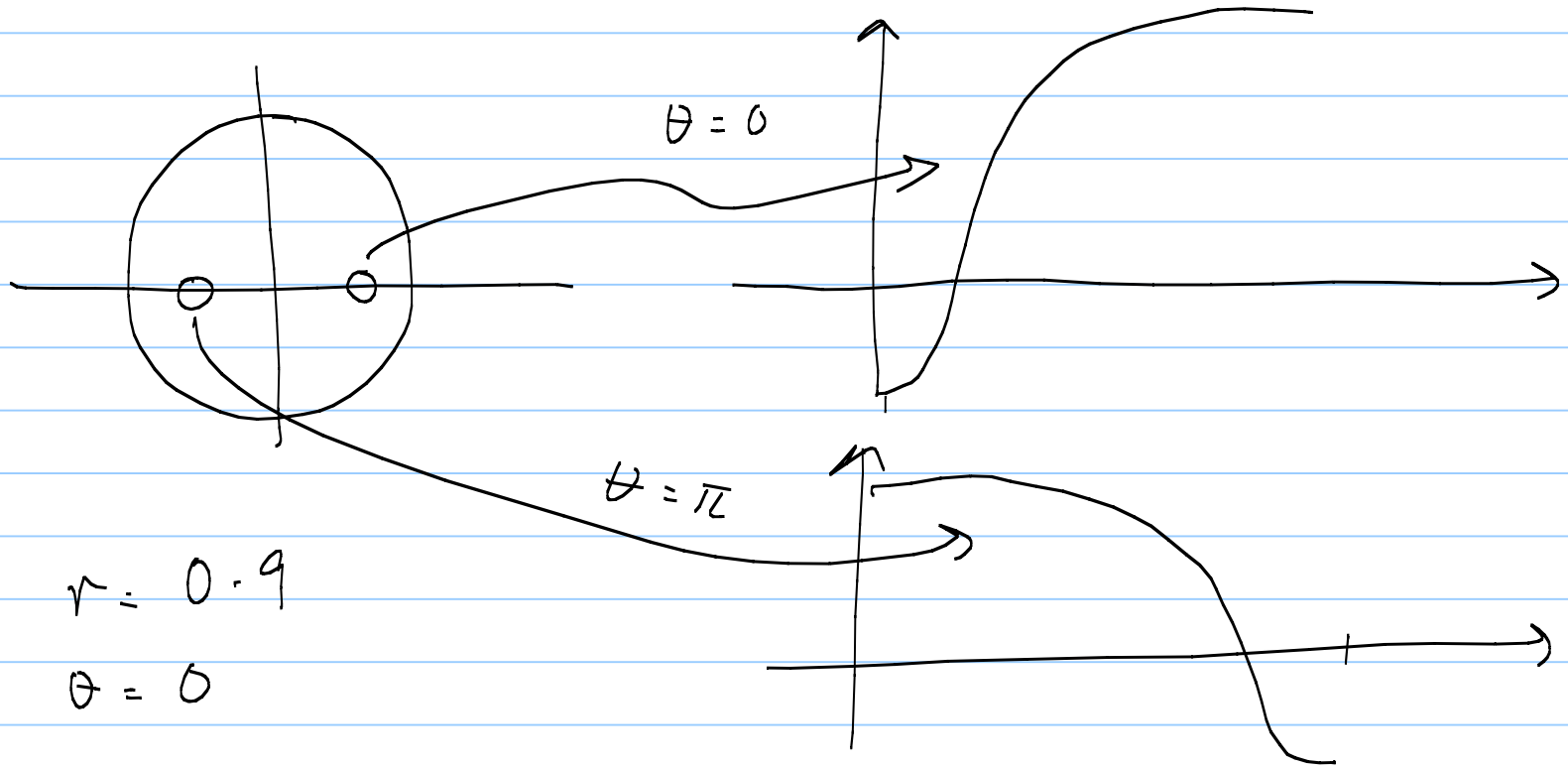


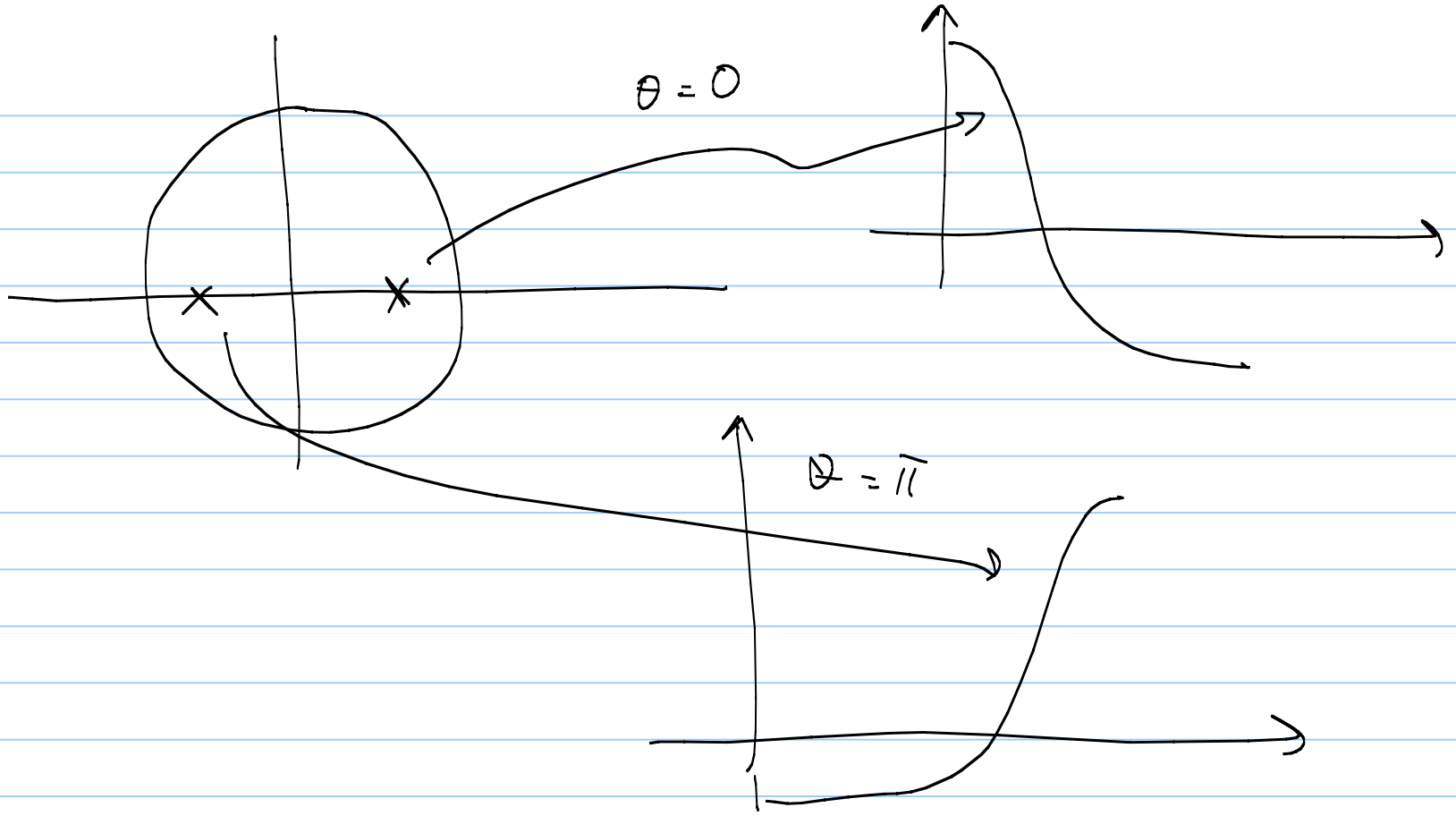


$$|H(s)|_{s=j\Omega} = \frac{|k| \prod_{\ell=1}^{M} |(s - B_\ell)|}{\prod_{k=1}^{N} |s - p_k|}$$

$s = j\Omega$

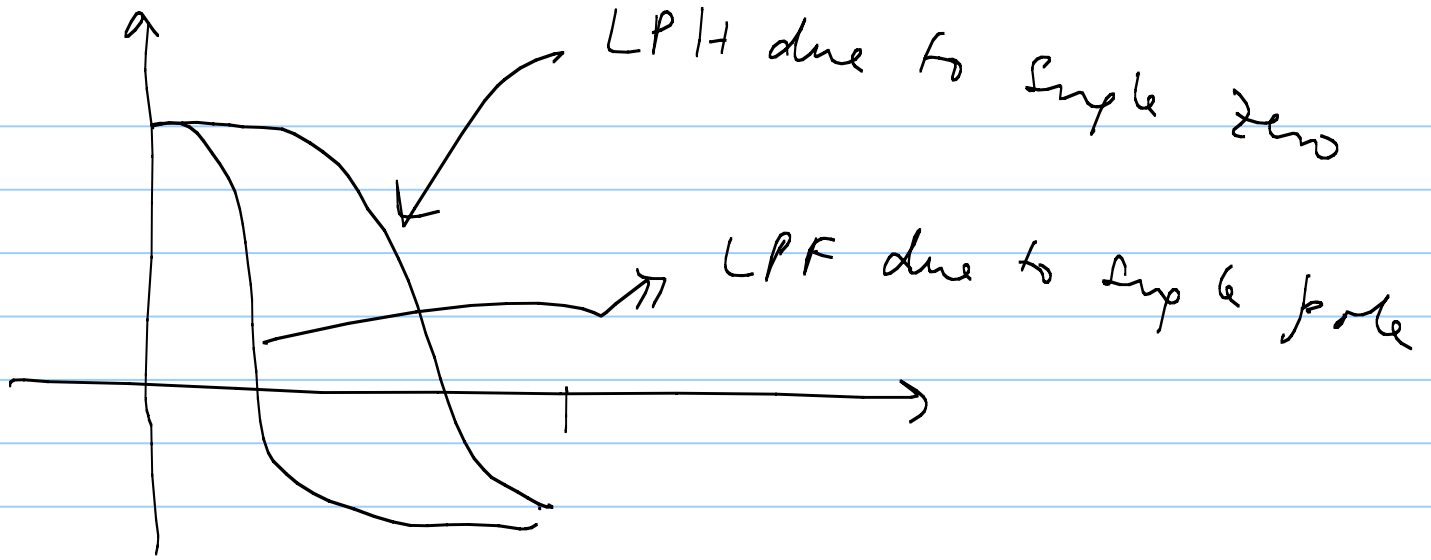

|H(Ω)|
Ω₀
Ω


θ = 0
θ = π
r = 0.9
θ = 0


θ = 0
θ = π

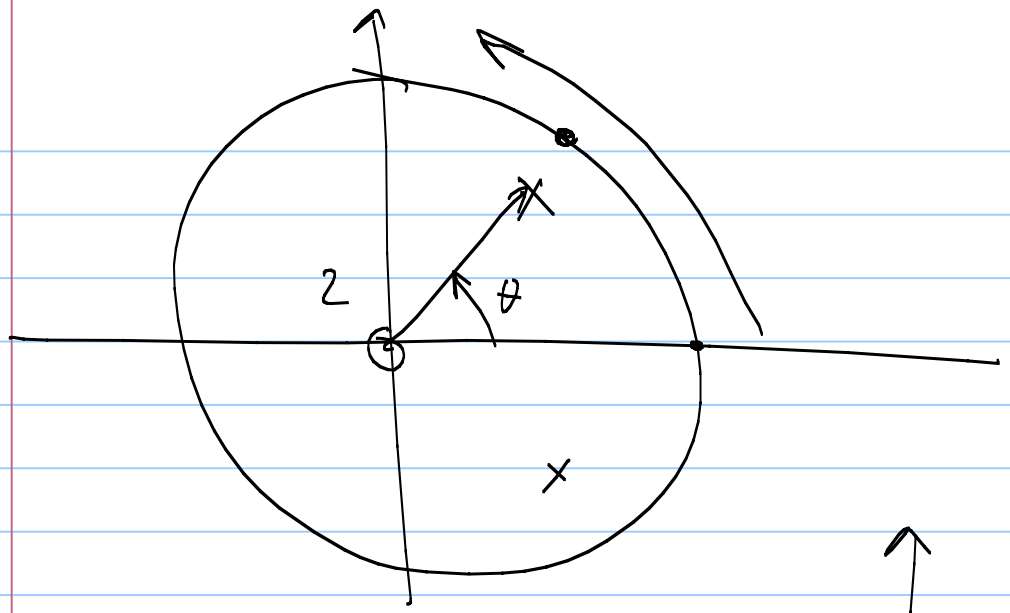
$r = 0.9$

From the 3dB BW



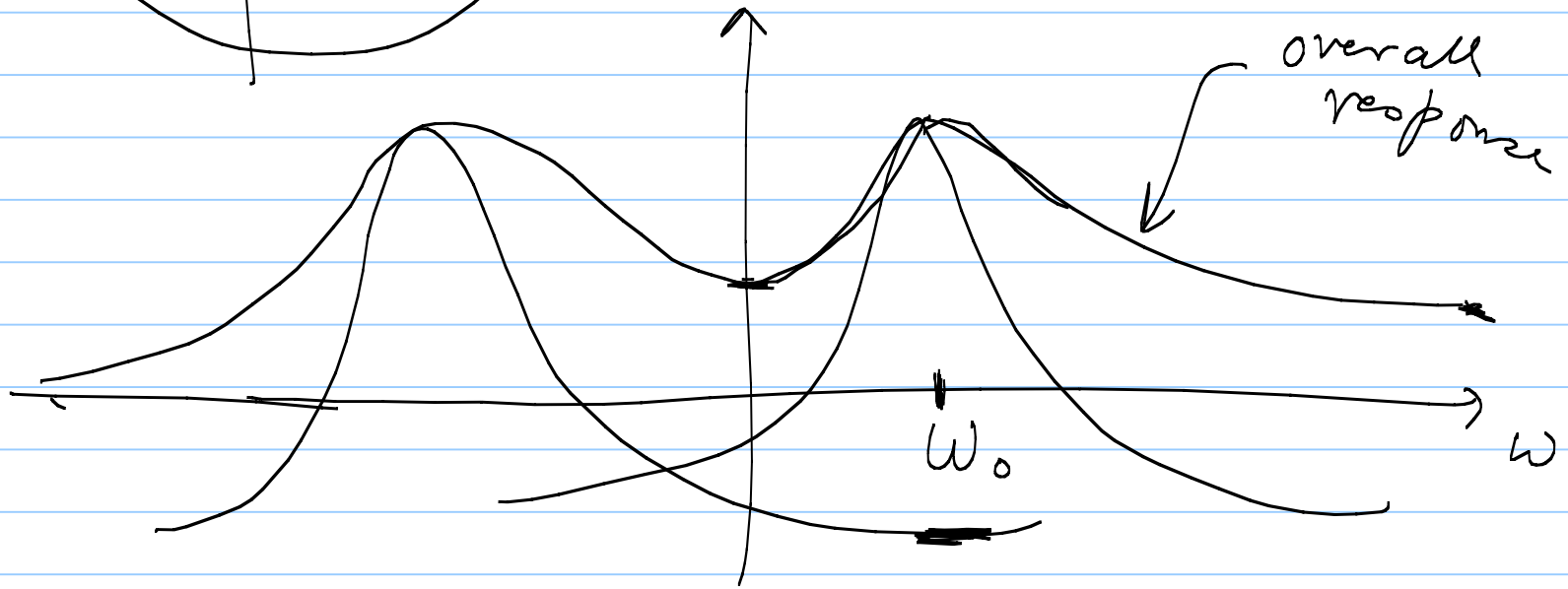
zero: $\pi/2$

pole: $\pi/30$



$$H(z) = \frac{1}{1 - 2r\cos\theta\, z^{-1} + r^2 z^{-2}}$$

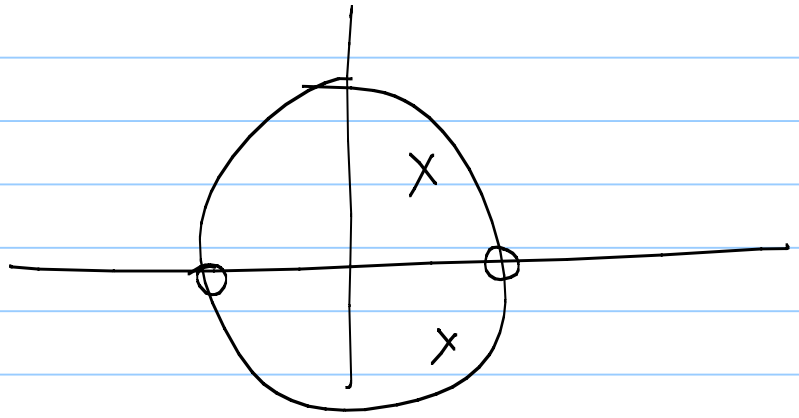
2^{nd} order resonator



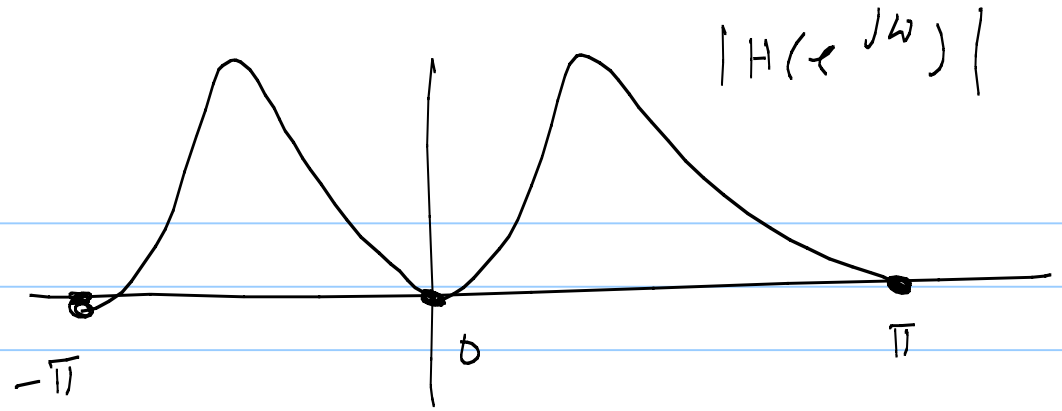
$$W_0 = \cos^{-1}\left[\frac{1+r^2}{2r}\cos\theta\right]$$

If $\theta = \pi/2$, $\quad W_0 = \pi/2$

$$-1 \le \frac{1+r^2}{2r}\cos\theta \le 1$$



$$\frac{1 - z^{-2}}{1 - 2r\cos\theta\, z^{-1} + r^2 z^{-2}}$$


$|H(e^{j\omega})|$
$-\pi$
0
π