Again, were mainly concerned how w1 phase margin; i.e., stability.

How does a RHP zero affect the PM?

- compare a LHP zero w/ a RHP zero:

1. LHP zero: (and 2 poles)

   \[ H(s) = \frac{\sqrt{\omega^2 + \epsilon^2}}{\omega^2 + \epsilon^2} \]

   \[ |H(j\omega)| = \frac{\sqrt{\omega^2 + \epsilon^2}}{\sqrt{\omega^2 + \epsilon^2}} \]

   \[ \angle H(j\omega) = -\tan^{-1} \left( \frac{\omega}{\epsilon} \right) - \tan^{-1} \left( \frac{\epsilon}{\omega} \right) \]

   \[ = -\tan^{-1} \left( \frac{\omega}{\epsilon} \right) - \tan^{-1} \left( \frac{\epsilon}{\omega} \right) \]

   Thus:

   - no gain
   - delta帮
   - This is adding phase - helping the PM!

   - unity gain freq. increased!
   - (good!)

   - very long unity gain PM!
   - (good!)

2. RHP zero: (and 2 poles)

   \[ H(s) = \frac{\sqrt{\omega^2 + \epsilon^2}}{\omega^2 + \epsilon^2} \]

   \[ |H(j\omega)| = \frac{\sqrt{\omega^2 + \epsilon^2}}{\sqrt{\omega^2 + \epsilon^2}} \]

   \[ \angle H(j\omega) = -\tan^{-1} \left( \frac{\omega}{\epsilon} \right) - \tan^{-1} \left( \frac{\epsilon}{\omega} \right) \]

   \[ = -\tan^{-1} \left( \frac{\omega}{\epsilon} \right) - \tan^{-1} \left( \frac{\epsilon}{\omega} \right) \]

   Thus:

   - unity gain freq. still extended
   - (bad! since the phase keeps going down!)

   - unity gain PM = (con) unstable!

   Problem:

   - to solve, must first understand where the zero comes from!