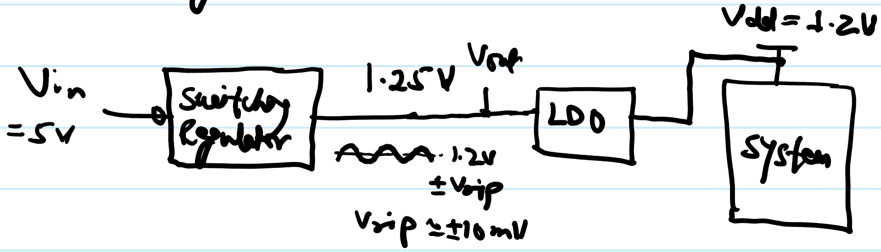
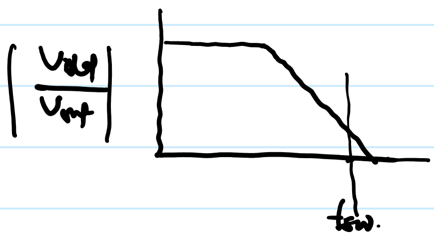
Applications of LDOs

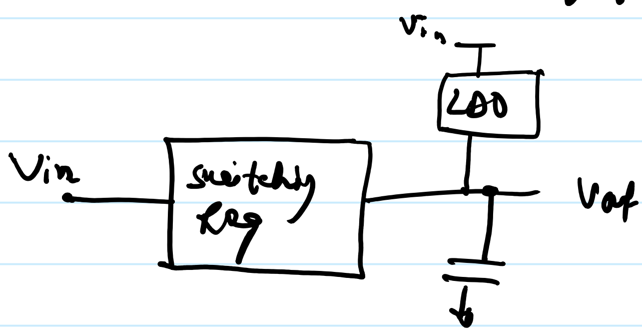
Regulator with lower Vin - Vout → dropout

Sub-regulated LDOs

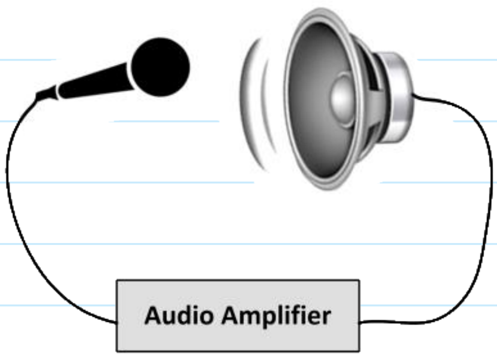




Parallel supply → to handle higher load current and fast transients

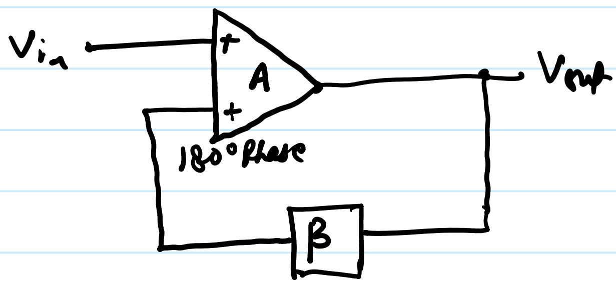


Overview of Feedback System and Stability



Positive Feedback → unstable

Air conditioner → negative Feedback (stable)



$$\frac{V_{out}}{V_{in}} = \frac{A}{1 + A\beta}$$

$$A\beta = -1$$

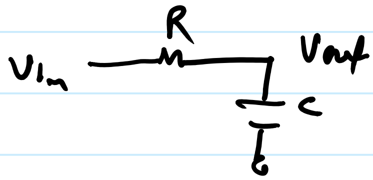
$$\frac{V_{out}}{V_{in}} \rightarrow \infty$$

$A\beta$ → Loop Gain

β → feedback factor

A → feedforward gain

First Order System



$$\omega_p = \frac{1}{RC}$$

$$H(s) = \frac{1}{1 + s/\omega_p}$$

$$|H(s)| = \frac{1}{\sqrt{1 + (\omega/\omega_p)^2}}$$

$$\angle H(s) = -\tan^{-1}\left(\frac{\omega}{\omega_p}\right)$$

$$|H(s)| = \frac{\omega_p}{\omega} \quad \text{for } \omega >> \omega_p$$

$$|H(s)|\ (dB) = -20 \log_{10}\left(\frac{\omega}{\omega_p}\right)$$

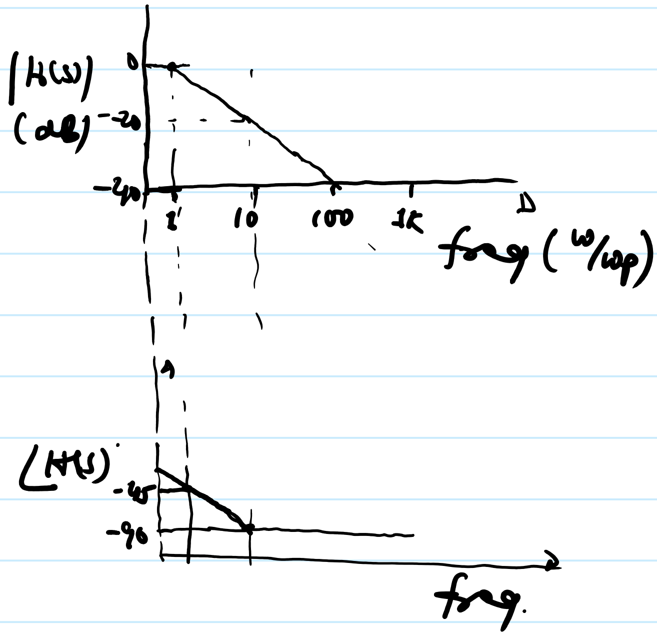
$$\omega = 10\,\omega_p$$

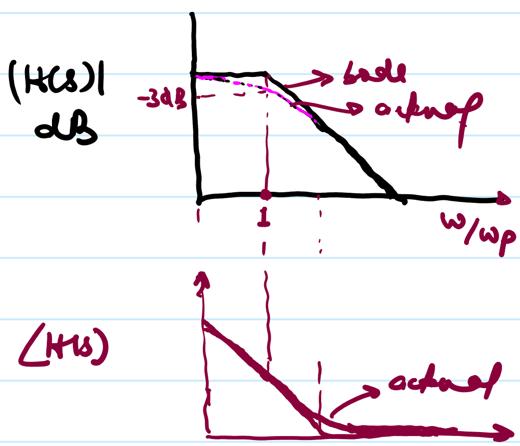
$$|H(s)| = -20dB$$

$$\angle H(s) = -45^\circ \quad \text{for } \omega = \omega_p$$

$$\angle H(s) \simeq -85^\circ \quad \text{for } \omega = 10\,\omega_p$$

Bode Plot


|H(ω)|
(dB)
0
-20
-40
1
10
100
1K
frq (ω/ωp)
∠H(s)
-45
-90
frq.


|H(s)|
dB
-3dB
bode
actual
1
ω/ωp
∠H(s)
actual