

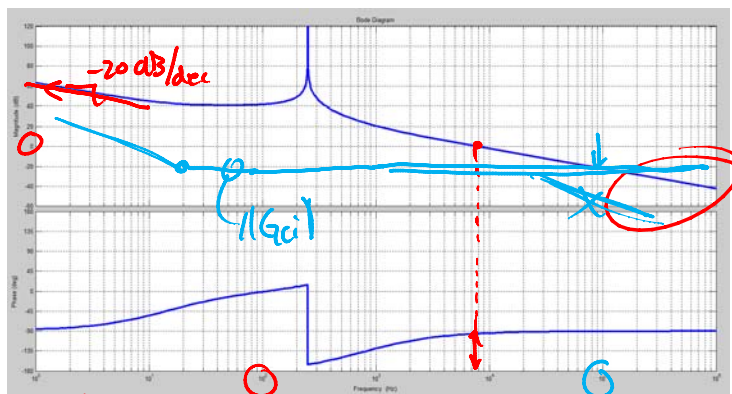


# Voltage Loop and Compensator Design

ECE 482 Lecture 9  
February 10, 2014

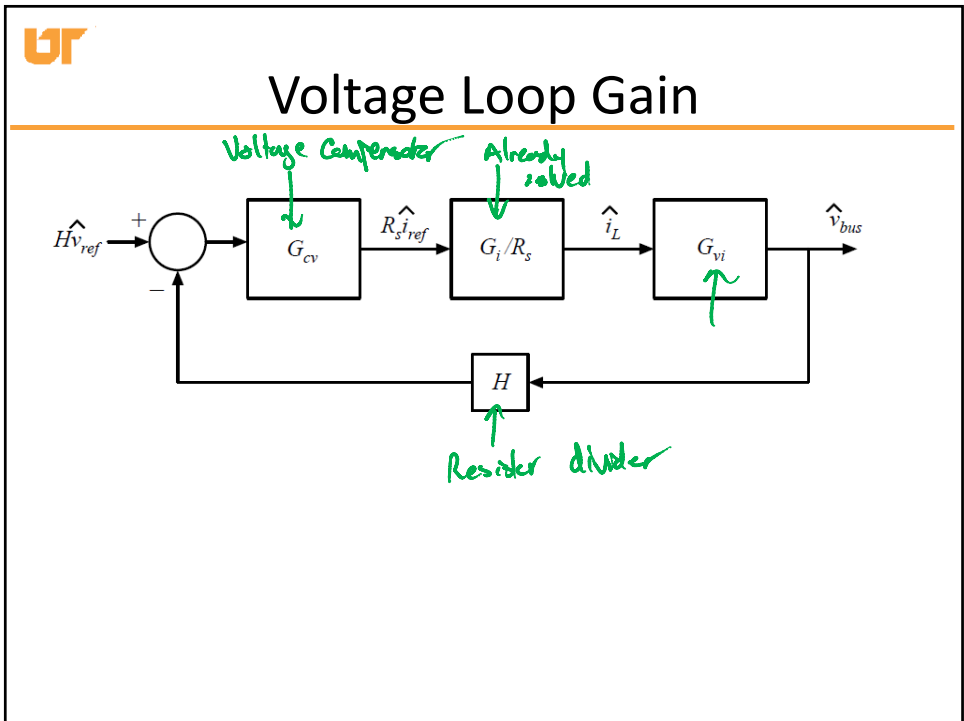
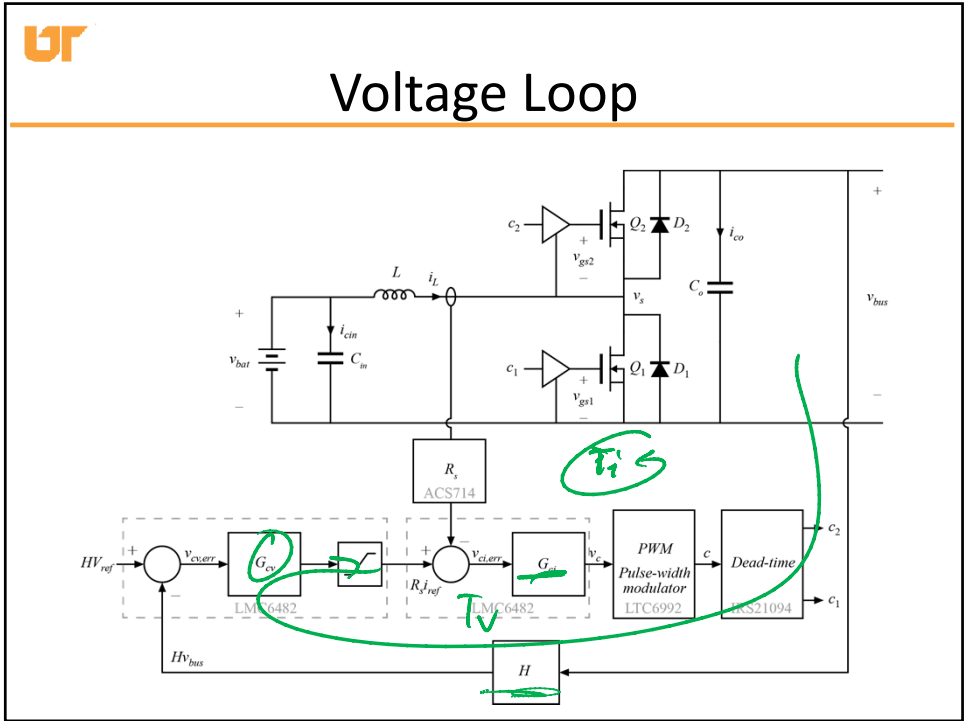


## Compensated Loop Gain



$$G_{ci} = \frac{1}{10} \left( 1 + \frac{\omega_{ci}}{s} \right)$$

$\omega_{ci} = 3 \frac{\text{krad}}{\text{sec}}, \phi_m = 84^\circ$



UT

## Solving $G_{vi}$

$$G_{vi} = \frac{\hat{v}_{bus}}{\hat{i}_L} \Big|_{\hat{v}_{bar}=0, \hat{i}_{bus}=0}$$

$$\hat{v}_{bus} = \frac{1}{sC} \hat{i}_c = \frac{1}{sC} (\hat{i}_c D' - I_L \hat{d})$$

$$G_{id} = \frac{\hat{i}_c}{\hat{d}} \rightarrow \hat{d} = \frac{\hat{i}_c}{G_{id}}$$

$$\hat{v}_{bus} = \frac{1}{sC} (\hat{i}_c D' - \frac{I_L}{G_{id}} \hat{i}_c)$$

$$G_{vi} = \frac{\hat{v}_{bus}}{\hat{i}_c} = \frac{1}{sC} \left( D' - \frac{I_L}{G_{id}} \right)$$

UT

## Solving $G_{vi}$



## Solving $G_{vj}$

$$G_{vj} = \left. \frac{\hat{v}_{bus}}{\hat{i}_L} \right|_{\hat{v}_{bar}=0, \hat{i}_{bar}=0} = G_{vio} \frac{1 - \frac{s}{\omega_z}}{1 + \frac{s}{\omega_{zi}}}$$

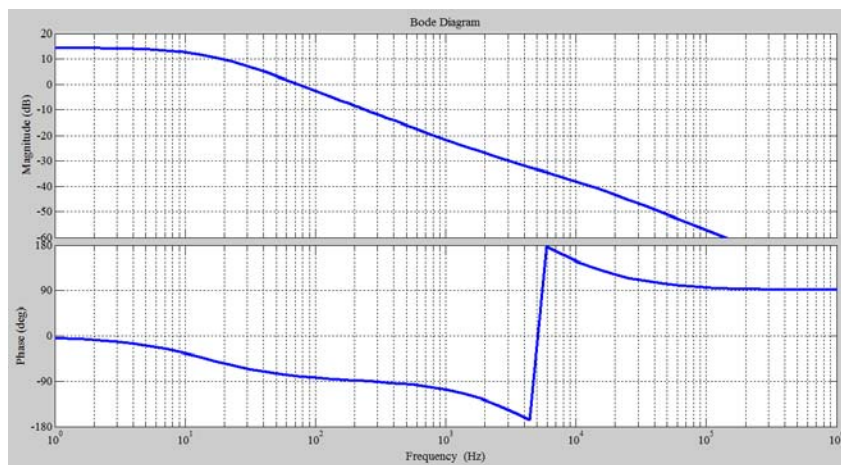
$$G_{vio} = D' \frac{V_{bus}}{I_{bus}}$$

$$f_z = \frac{1}{2\pi} \frac{D'^2 V_{bus}}{L I_{bus}}$$

$$f_{zi} = \frac{1}{2\pi} \frac{1}{C} \frac{I_{bus}}{V_{bus}}$$

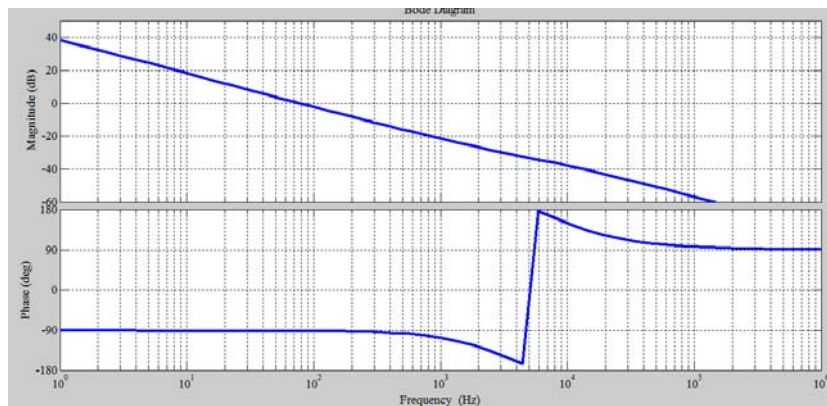


## Uncompensated Voltage Loop Gain





## Compensated Loop Gain

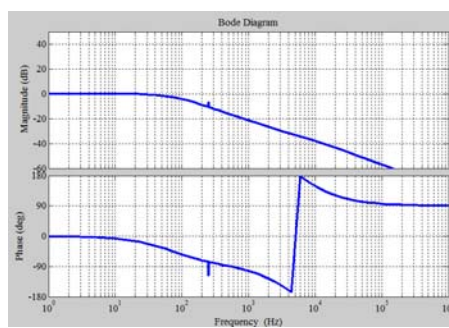
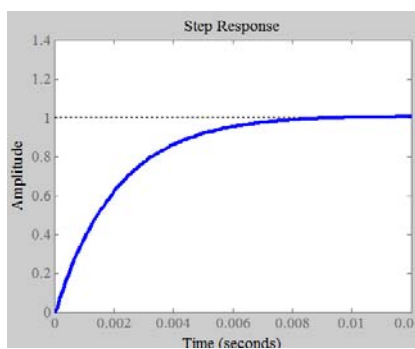


$$G_{ci} = 1 \left( 1 + \frac{\omega_{zv}}{s} \right)$$

$$\omega_{zv} = 100 \frac{\text{rad}}{\text{sec}}, \varphi_m = 88^\circ$$



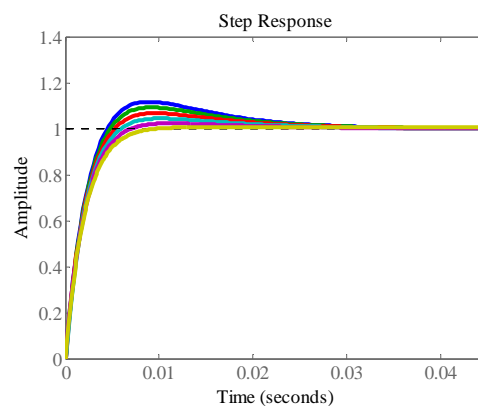
## Closed Loop $G_v$





## Variations in DC Operation Point

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## Compensator Realization

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