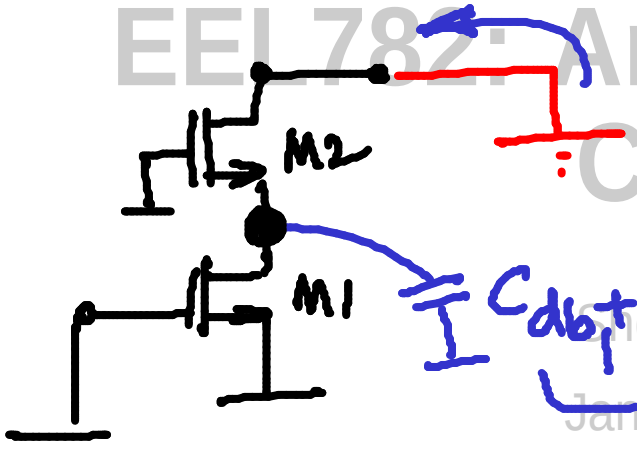
$G_m(s)$

$Z_{out}(s)$



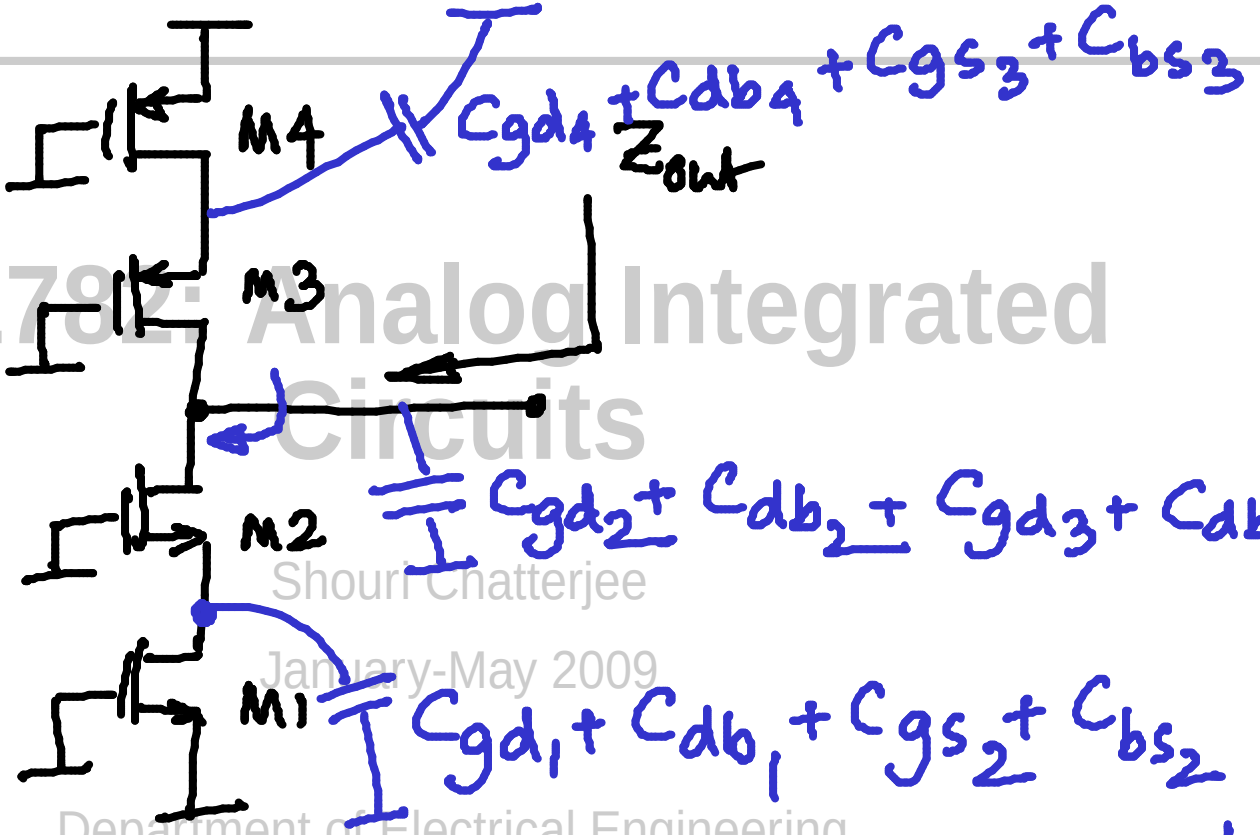
$C_{db_1} + C_{gs_2} + C_{sb_2} + C_{gd_1}$

Zero at $+\dfrac{g_{m_1}}{C_{gd_1}}$

$$\frac{1}{g_{m_2}} \| r_{ds_1} \| r_{ds_2} \approx \frac{1}{g_{m_2}}$$

$$\approx g_{m_1} \frac{1 - s\,C_{gd_1}/g_{m_1}}{1 + s \cdot \frac{1}{g_{m_2}}(C_{db_1} + \ldots\ldots)}$$

$Z_{out}(s)$



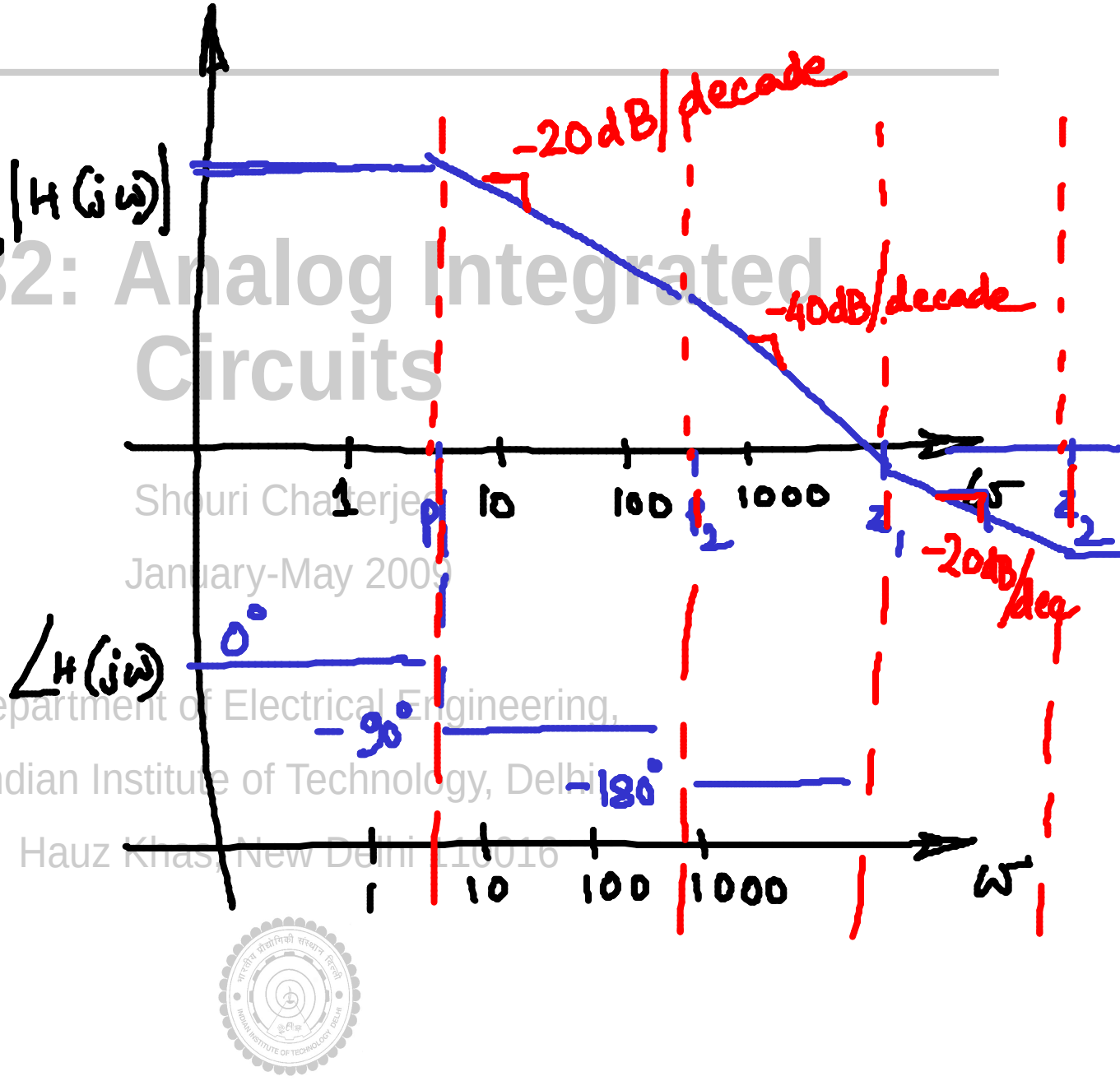
$$g_{m_2} r_{ds_2} \left(r_{ds_1} \| \left(\cdot \; C_1 \; \cdot \right) \right) = \left(g_{m_2} r_{ds_2} r_{ds_1} \right) \| \frac{C_1}{g_{m_2} r_{ds_2}}$$

$$\left(g_{m_2} r_{ds_2} r_{ds_1} \| g_{m_3} r_{ds_3} r_{ds_4} \right) \| \left(\frac{C_1}{g_{m_2} r_{ds_2} g_{m_3} r_{ds_3}} + \frac{C_2}{g_{m_3} r_{ds_3}} \right) \qquad \left(g_{m_3} r_{ds_3} r_{ds_4} \right) \| \frac{C_2}{g_{m_3} r_{ds_3}}$$

Bode plots

$H(j\omega)$

$20 \log_{10}|H(j\omega)|$



$$H(s) = A \cdot \frac{(1 + s/z_1)(1 + s/z_2)}{(1 + s/p_1)(1 + s/p_2)}$$

$$p_1 \ll p_2 \ll z_1 \ll z_2$$

$$20 \cdot \log\left(H(j\omega)\right) = 20 \cdot \log\left(|H(j\omega)|\, e^{j\angle H(j\omega)}\right)$$

$$= \underbrace{20 \log|H(j\omega)|}_{①} + \underbrace{20j \log_{10} e \cdot \angle H(j\omega)}_{②}$$

① $$20 \log|H(j\omega)| = 20 \log\left(A \cdot \frac{|1 + s/z_1|\,|1 + s/z_2|}{|1 + s/p_1|\,|1 + s/p_2|}\right)$$

$$= 20 \log A + 20 \log|1 + j\omega/z_1| + 20 \log|1 + j\omega/z_2|$$

$$- 20 \log|1 + j\omega/p_1| - 20 \log|1 + j\omega/p_2|$$

$-20 \log(\omega/p_1)$

$$\angle H(j\omega) = \angle A \cdot \frac{(1+j\omega/z_1)(1+j\omega/z_2)}{(1+j\omega/p_1)(1+j\omega/p_2)}$$

$$= \angle 1+j\omega/z_1 + \angle 1+j\omega/z_2 - \angle 1+j\omega/p_1 - \angle 1+j\omega/p_2$$

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