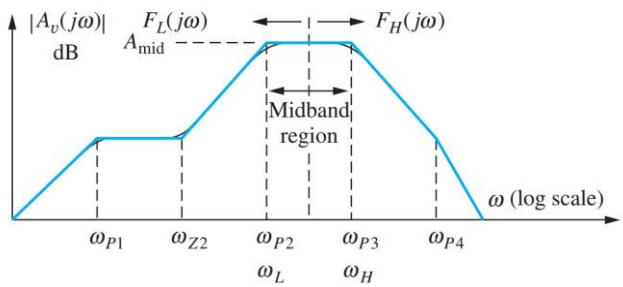
EE112 - Fall 2016
Analog Integrated Circuits I

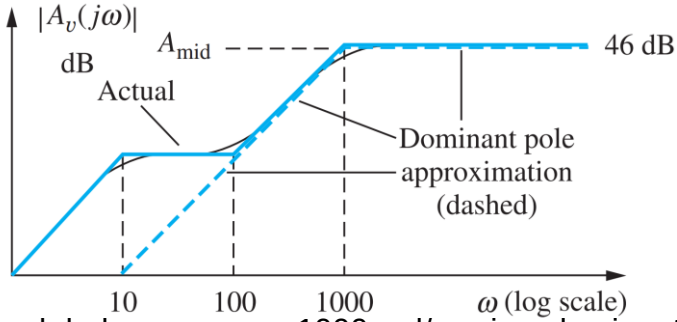
Prof. Haoyu Wang
wanghy@shanghaitech.edu.cn
5210 Research Bldg.

Amplifier Frequency Response
Transfer Function Analysis



Low Frequency Dominant Pole Approximation

- A ***Dominate Pole*** exists if one of the low frequency poles is much larger than the others.



  - » In the graph below case ω = 1000 rad/sec is a dominant pole.
  - » All other poles and zeros are at low enough frequencies that they do not affect the lower cutoff frequency ω_L.

Lower Cutoff Frequency Calculations

- If there is no dominant pole at low frequencies, the poles and zeros interact to determine the lower cutoff frequency ω_L.

- Lower cutoff frequency ω_L will be greater than all the individual pole zero frequencies.

Dominate Pole Example

- Problem: Find midband gain, F_L(s) and f_L for

$$A_L(s) = 2000\frac{s\left(\frac{s}{100}+1\right)}{(0.1s+1)(s+1000)}$$

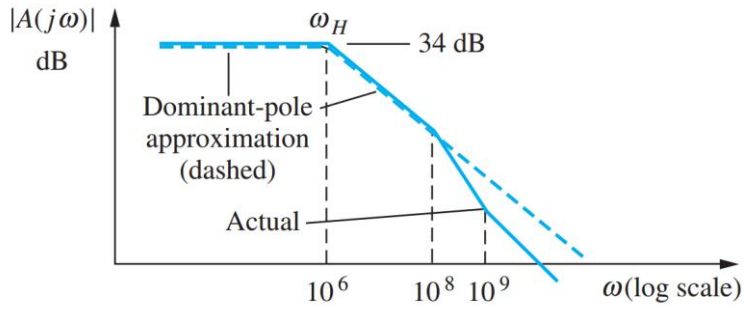
- Analysis:

High-Frequency Dominate Pole

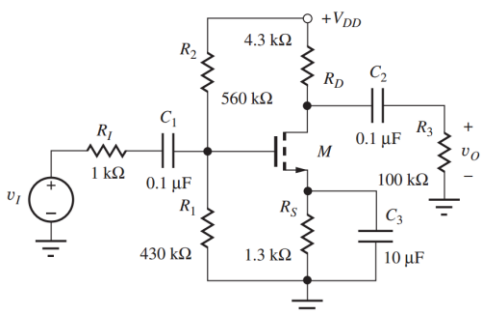
- The lowest of all high frequency poles is called the dominate high-frequency pole

- If there is no dominant pole at high frequencies, the poles and zeros interact to determine ω_H

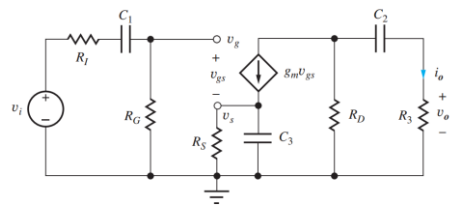
High Frequency Dominate Pole Approximation



Low-Frequency Poles and Zeros Direct Calculation: C-S Amplifier



(a)



(c)

Continued

- Each independent capacitor in the circuit contributes one pole and one zero.
- Series capacitors C_1 and C_3 contribute the two zeros at s = 0 (dc), blocking propagation of dc signals through the amplifier.
- The third zero due to the parallel combination of C_2 and R_S occurs at frequency where signal current propagation through the MOSFET is blocked (output voltage is zero).