

EEXXXX Analog IC Analysis & Design - I 2019. Fall.

HW6

Due date : 2019. 12. 21 (Sat.) 23:59pm (upload to iLMS System)

First release : 2019. 12. 7

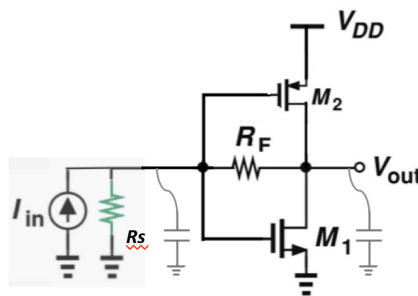
HW6 –Feedback Amplifier

This homework is a **feedback amplifier**. The problem sets include HSPICE simulations and the comparison with hand calculations. The SPICE model is cic018.l.

Please note:

1. Please hand in your report using LMS.
2. Please note, **no delay allowed!!!**
3. Please generate your report with **pdf** format (AIC_HW{X}_StudentID.pdf). At first page please add your student ID and name. Try to make the information “readable”. (Note: Don’t use black color in background for your screen capture figures).
4. Please **hand in the spice code file** (AIC_HW{X}_StudentID.sp) with your report for each work. Do not include output file.
5. Please fill the results into hw06.xlsx. **(without this file, -20pt)**
6. Do not zip your whole package.

Please attached your spice code for each working item in your report.



In this circuit, please use $V_{DD}=1.5V$. The shunt resistance R_F is assumed $1K\Omega$ ohm. Input and output nodes are with $1pF$ load respectively. Current source is assumed with $100K\Omega$ R_s impedance.

- (a) Please design your core amplifier M1, M2, to get the **transimpedance DC gain** (V_{out}/I_{in}) larger than $0.95K\Omega$. And its **bandwidth (-3dB point)** has to be wider than $150MHz$.
- (b) Please use **.tf** command to print out the gain, input and output impedances.

- (c) Please use **.op** command to print out the device parameters. And use the parameters from HSPICE to hand-calculate the results. Make a comparison table with (b).
- (d) Plot this feedback amplifier frequency response and mark the poles, zeros. Please use **.pz** command and print out the data.
- (e) Like (c) please hand calculate the poles and zeros using simulation values.
- (f) The FoM in this design is “**Bandwidth (MHz) / Current (μA)**”. Try to maximize this FoM.
- (g) Please discuss your design flow and results.

Working Item	Specification	Simulation result	Hand calculation
Vdd	1.5-V		
Current (μA)	(μA)#1		
Transimpedance gain (KΩ)	> 0.95KΩ		
core amp size (W/L _N , W/L _P)			
core amp gm (gm _N , gm _P)			
core amp ro (ro _N , ro _P)			
Bandwidth (-3dB) (MHz)	>150MHz#2		
Closed-loop poles/zeros			
Closed-loop input impedance			
Closed-loop output impedance			
FoM (MHz/μA)	#2/#1		