Electronics

Assignment 2

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Introduction

The purpose of this assignment is the simulation of elementary MOS and BJT amplifier stages.

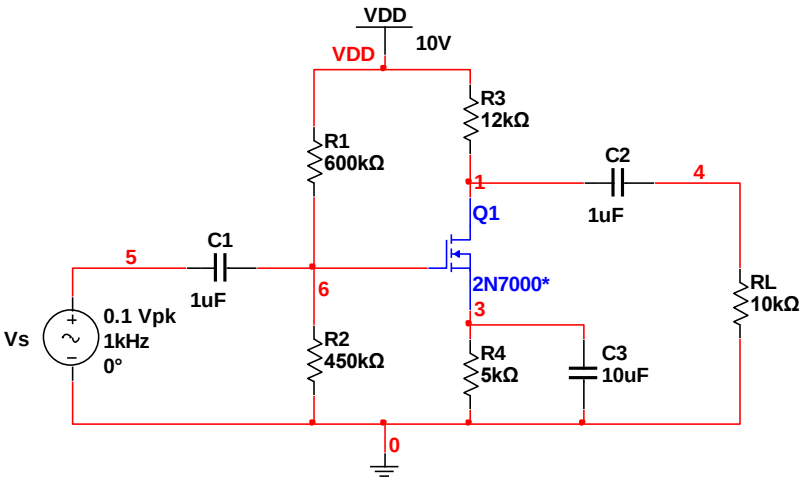
A report containing the description of the performed simulations, circuit diagrams, results in the form of tables and plots (where applicable) should be prepared. The report should also contain, if applicable, comparison between the theoretical and simulation results, as well as comments and conclusions. **All MultiSim files should be attached to the report, otherwise, it will not be evaluated and the grade will be zero.**

Task 1: Simulation of the CS Amplifier

1. Implement the common-source MOS amplifier shown below. The transistor model should be modified to look as follows:

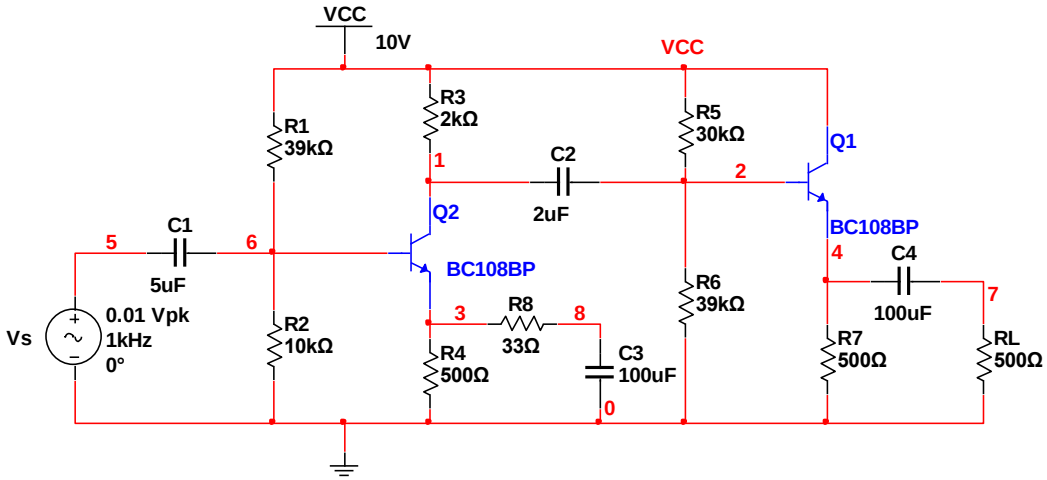
   ```
   Cgs  2 3 20E-12
   Cgd 1 2 10E-12
   M1 1 2 3 3 MOST1 W=500u L=2u
   .MODEL MOST1 NMOS(Level=3 Kp=20u W=500u L=2u Rs=20m Vto=2 Rd=1.186)
   ```

2. Using the above parameters (here: k_n = 20 μA/V^2, W/L = 250, V_T = 2 V, C_{gs} = 20 pF, C_{gd} = 10 pF) perform the theoretical analysis of the circuit to find the voltage gain, input resistance, output resistance, as well as to estimate the lower and upper 3dB frequencies.
3. Determine the values of the same parameters by simulation. Note that in order to obtain some of the parameters certain changes in the circuit diagram and/or introducing some auxiliary elements may be necessary.
4. Compare the parameters obtained by simulation with those obtained from the theory and comment upon possible differences.



Task 2: Simulation of a Two-Stage BJT Amplifier

1. Implement the CE-CC amplifier shown below:



2. Using proper simulation techniques, determine the following parameters of the circuit:
   (i) Midband voltage gain,
   (ii) Input resistance,
   (iii) Output resistance,
   (iv) Lower 3dB frequency,
   (v) Upper 3dB frequency,
   (vi) Maximum output voltage amplitude for which the total harmonic distortion of the output signal is less than 5% at the input signal frequency of 1kHz.
3. Summarize the circuit parameters in a table and attach relevant plots. Explain the simulation techniques that you exploited.