ENEE 417 - Fall2006
Weeks #5-6; starting 09/27/06
Design #2: Active Inductor

Be sure to have your base paper and to have made a parts list from your final choice of circuit and and give this to the laboratory technicians; verify that they will be able to obtain the parts needed.

a). In this experiment for week 5 an active inductor will be designed, constructed, and tested; use the 4007 CMOS transistors for which the Spice models are in the library file analog.lib. Your transistor curves measured in LabView or in PSpice will be of help in your designs.

b) Investigate the following circuit for which more information can be found in the reference Y. Wu, M. Ismail, and H. Ollson, "A Novel CMOS Fully Differential Inductorless Bandpass Filter," Proceedings of the IEEE International Symposium on Circuits and Systems (ISCAS), Geneva, May 2000, pp. IV-149 - IV-152.

1. Download the reference from the University of Maryland library home page Research Port for electronic journals (go to the IEEE page through the E-journals port and under Browse go to Conference Proceedings) and set up the equations for the small signal input impedance. Use the 4007 parameters with Ib1=Ib2 and Vss=-Vdd with these chosen to guarantee both Mp1 & Mp2 are biased in saturation (an initial trial may be Ib1=1mA and Vdd=5v). Choose a nominal value of Vb=0V. PSpice curves for the 4007 transistors should be helpful and carrying out this design.
2. Design MOS current sources to give your values of Ib1 and Ib2. Run Pspice to check proper biasing with your transistorized current sources. Then run a frequency response to check over what frequency range this acts as an inductor.
3. Design a test configuration to check that the behavior is as an inductor over the frequency range just found.. Consider using a resistor and the resulting time constant and a capacitor and frequency of resonance.
4. On your breadboard build the circuit and test it using your methods just developed.
    Use LabVIEW to computer control the bias supply and record Iin versus Vin for a sinusoidal Vin at different frequencies of interest.
5. Design an NMOS version of this active inductor.