ELEN 665 (ESS)
Fall '07

PROPOSED FINAL PROJECTS

These final projects can be carried out by one student or a team of two students. However it is strongly suggested to have a team of two. Please provide a list of your first three choices by Nov 15 before noon. All projects will use 0.35μm unless otherwise specified.

Project 1 Design at the transistor level a UWB LNA for the frequency range 3 ~ 10.6 GHZ. Propose a high frequency linearization technique to meet the linearity requirements for the UWB systems. Compare your results with the technique that used a transistor biased in the weak inversion for linearization. The LNA should satisfy the following specifications:

- BW: 3.1~10.6GHz
- IIP3 > 10dBm
- S11<-10dB
- S21 > 10dB
- NF< 4dB
- Power: Minimum

Use Taylor / Volterra series to do theoretical analysis for the proposed linearization technique.

Project 2 Design at the transistor level an LNA for the RFID standard. Propose a high frequency linearization technique to meet the high linearity requirements for the RFID reader. The LNA should satisfy the following specifications:

- BW: 860~960MHz
- Input P1dB > 10dBm
- S11<-10dB
- Voltage Gain > 10dB
- NF< 8 dB
- Current consumption: < 30mA

Use Taylor / Volterra series to do theoretical analysis for the proposed linearization technique.

Reference: A. Safarian et al., "An integrated RFID reader," IEEE ISSCC, 2007.

Project 3 Propose a system architecture for the RFID reader to reduce the leakage problem. Analyze a single chip mobile UHF RFID reader standard and extract the required system specifications. Propose a new system architecture employing a leakage signal cancellation scheme to suppress Tx leakage into Rx input. Compare your results with the recently published self-leakage canceller.

Reference: J. Lee et al., "A UHF mobile RFID reader IC with self-leakage canceller," IEEE RFIC, 2007.

Project 4 Design the power generating circuitry for a passive RFID tag. The power generation circuitry should include a supply regulation, charge pump. The operating frequency range is from 860-960MHz UHF band. The power generation circuit should generate a 2V supply voltage from a input signal leveled at 11.6dBm. The regulator should supply an output voltage of 1.6V with at least 50uA of current. The data dependent supply variations should not exceed 250 mVpp at the unregulated output of the charge pump and/or rectifier circuitry.

Project 5 Design a non-linear power amplifier at 2.4GHz. The non-linear Power Amplifier should deliver an output power of 10 dBm for a load of 50Ω (antenna). Optimize the efficiency. Apply one of the existing linearization techniques to increase IIP3 to 30 dBm. Discuss the effect of the linearization technique on the efficiency. Propose a new kind of linearization technique to reduce complexity and power consumption of the additional circuits.

Project 6 Design a signal separator at 2.4 GHz to be used in LINC technique. The goal is to design/propose a low-power signal component separator to be used in a LINC PA. SCS should not consume more than 50mW when realized in 0.35u CMOS technology. Discuss the challenges and trade-offs. Discuss the various non-idealities using system-view simulation that shows the effects of non-idealities on the linearity of whole LINC.

References:

L. Tee. E. Sacchi, R. Bocock, N. Wongkomet. P. Gray , "A Cartesian-Feedback Linearized CMOS RF Transmitter for EDGE Modulation", Symposium on VLSI Circuits 2006

Panseri, L. Romano, L. Levantino, S. Samori, C. Lacaita, A.L., "Low-Power All-Analog Component Separator for an 802.11a/g LINC Transmitter", ESSCIRC 2006

Final Written Report (December 8, 2007). This final word document must include:

1. Title
2. An abstract
3. Introduction
4. Background and a comparative table of previous results
5. Proposed Solution
    - Conceptual idea of the solution
    - Circuit Design and explanation
    - Design Procedure, how to determine the (W/L)'s, bias.
    - The temperature, noise and process variation effects
6. A Comparative Table between Hand calculation and Simulation

7. Discussion of results with other reported results and suggested improvements.
8. Layout of the Circuit
9. References, a complete list of reference must be included

Oral Presentations in PowerPoint Form: Day of schedule final exam, December 3 and 5, 2007