Academic Projects

Design and layout of fully differential telescopic cascode amplifier with CMFB:

- Designed differential telescopic opamp for the Gain = 72 dB, differential output swing = 3V, power dissipation = 10mW, Gain-Bandwidth product: 122MHz, supply = 3V.
- Obtained device dimensions form required output swing, bias current, overdrive voltages and increased PMOS devices width for higher gain.
- Obtained bias voltages from input CM level, Performed DC analysis to check the operating point of all the transistors, AC, stb analysis to find loop gain, stability requirements.
- Located poles of the opamp and increased output capacitance for meeting the bandwidth and phase margin requirements.

Process corner analysis and Monte Carlo analysis:

- Analyzed variation of β_{eff} and V_{th} variation of four diode connected MOSFET's under different process corners by setting the environment in ADEXL (Process-Mismatch statistical variation in Montecarlo).
- Understood process corners like strong, weak, typical and respective V_{th} and current variation by doing DC analysis on four transistors.

Designed Bandgap reference circuit:

- Designed CTAT circuit with a diode (BJT), PTAT with the series of diodes (BJT) and simulated respective voltages in reference to temperature.
- Observed PTAT slope is lesser than CTAT, used ratio of resistors to scale the PTAT with CTAT.
- Obtained reference voltage as 1.2 V and simulated the bandgap circuit in various process corners.
- Achieved low temperature coefficients of 150ppm/C across temperature range of -20^{o}C to 120^{o}C by efficient slope cancellation of PTAT and CTAT currents.

Design of Flash ADC

- This project involves design of a 4-bit Flash ADC with power consumption less than 1.5mW and sampling frequency 20MHz.
- A fully differential dynamic comparator is used so that input offset is contributed by differential pair.
- Studied and analysed performance metrics like kickback noise, offset, regeneration time.

Feedback Control System for a 75 W Buck Converter

- Designed a buck converter and its feedback control loop using a PID controller to obtain a phase margin of 30 degrees.
- Simulated the model on MATLAB to collect phase margin and observed time domain response at different input voltages.