DESCRIPTION

This course will present the graduate or advanced undergraduate student with the fundamentals of the design of analog integrated circuits. The methods and circuits discussed will cover bipolar, CMOS and biCMOS technologies, with emphasis on the relative merits and disadvantages of each. The use of computer-aided design and simulation tools and techniques will be an integral part of the course, although dependence on such techniques will be discouraged in favor of first-order pencil and paper derivations. The course will be divided into numerous small “modules”, proceeding from the most fundamental properties of individual devices through simple, single-stage circuits to multi-stage circuits and eventually to entire integrated analog systems. Where appropriate, each course “module” will conclude with a detailed theoretical and practical discussion of a specific analog building block circuit which uses or illustrates the concepts presented in that block. Course time will be equally divided between practical design and theoretical derivation.

SYLLABUS:

1. Bipolar and CMOS Device Characteristics
   ANALOG BUILDING BLOCK – Models and Computer Simulations  Week 1-2

2. Analog Integrated Circuit Technology  Week 3

3. Basic Bipolar and CMOS Amplifier Configurations
   ANALOG BUILDING BLOCK - The Emitter/Source-Coupled Differential Stage  Week 4-5

4. Current mirrors, active loads, and reference circuits
   ANALOG BUILDING BLOCK - The Bandgap Reference Cell  Week 6-7-8

5. Output (Driver) Stages
   ANALOG BUILDING BLOCK - The Class AB Push-Pull Driver  Week 9

6. Integrated CMOS Operational Amplifiers
   ANALOG BUILDING BLOCK – The CMOS Folded Cascode Amplifier  Week 10-11

7. Integrated Comparator Circuits and Data Converters
   ANALOG BUILDING BLOCK - The SAR ADC  Week 12-13

8. Reviews, mid-term examinations, holidays  Week 14-15

PREREQUISITES:

1. Graduate-level course in semiconductor device physics

TEXT:


2. IEEE J. Solid State Circuits, articles to be assigned.