EE5310: Analog Electronic Circuits
EE3002: Analog Circuits
Introduction

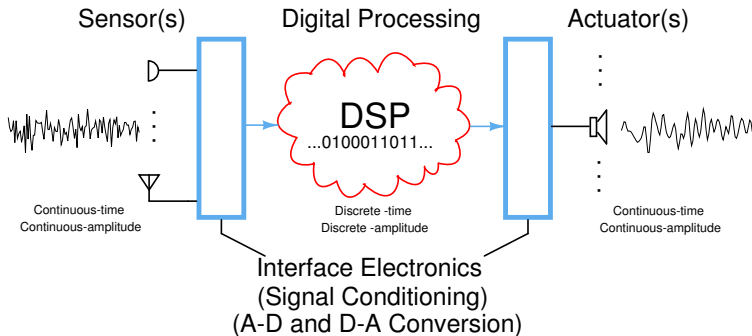Aniruddhan S
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30 July 2014

Sensor(s)

Digital Processing

Actuator(s)

DSP
...0100011011...

Continuous-time
Continuous-amplitude

Discrete -time
Discrete -amplitude

Continuous-time
Continuous-amplitude

Interface Electronics
(Signal Conditioning)
(A-D and D-A Conversion)

Picture:

courtesy Shanthi Pavan

- Analog to digital conversion
- Digital to analog conversion
- Amplification
- Signal processing circuits at high frequencies
- **Power management-voltage references, voltage regulators**
- **Oscillators**

The last two are found even on many "digital" ICs

- Many companies starting analog centers
- Multinationals and Indian start ups
- Big demand for skilled designers
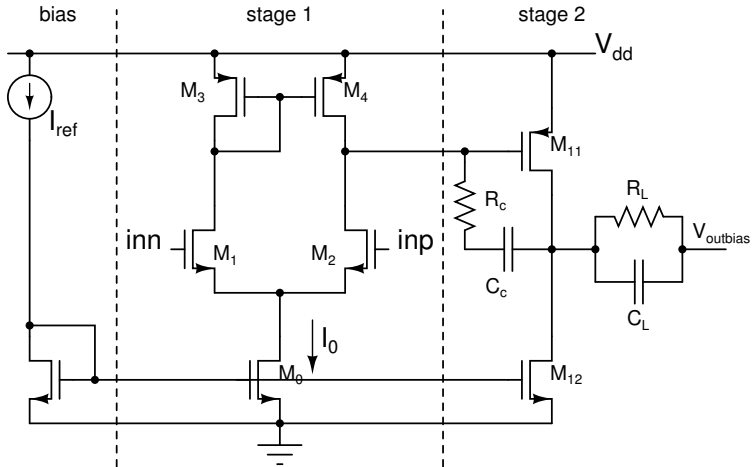- Interesting <u>and</u> profitable activity ☺

Theory

- Small signal analysis of nonlinear systems
- Analysis of nonlinearity and frequency response
- Stabilization of feedback circuits

Design

- Amplifier topologies
- Biasing techniques

- Circuit analysis
  - Mesh, nodal analyses
  - RLC, linear dependent sources
- Laplace transforms, frequency response
- Differential equations

EC1010: Electrical and Magnetic Circuits
EC2102: Networks and Systems

- Nonlinear circuits-incremental analysis
- Obtaining power gain; MOS transistor
- Amplifiers with MOS and BJTs
- Opamps, negative feedback, stability
- Applications: Active filter, voltage regulator

Follow up

- EC3300: Analog circuits lab
- EE5390: Analog IC design

- EE5323: Advanced Electrical Networks
- EE5340: Active filter design
- EE6240: RF integrated circuits
- EE6580: VLSI data conversion circuits
- EE6850: VLSI broadband communication circuits

Resources

Course homepage

- IITM moodle: https://courses.iitm.ac.in/
- http://www.ee.iitm.ac.in/vlsi/ee3002_2014/start

Recorded lectures

- http://www.ee.iitm.ac.in/~nagendra/videolectures/
- Lectures recorded in the classroom
- KRK Rao foundation on Analog Design, June 2008: (Review of basic concepts: Network analysis, small signal analysis, Transistor models, Negative feedback)
- NPTEL—Prof. VGK Murti's *Networks and Systems*, and other courses on circuit analysis.

Text book

- None

Resources

References

- A. S. Sedra and K. C. Smith, *Microelectronic Circuits*, 5ed, Oxford University Press, 2004.

- Sergio Franco, *Design with operational amplifiers and analog ICs*, Tata McGraw Hill.

- Hayt and Kemmerly, *Engineering Circuit Analysis*, McGraw Hill, 6/e.

- B. P. Lathi, *Linear Systems and Signals*, Oxford University Press, 2 edition, 2004.

- N. Krishnapura, "Introduction to EE539", http://www.ee.iitm.ac.in/~nagendra/EE539/200801/handouts.html

- E slot
- Roll numbers ending in 3, 6, 9: ESB106
- All others: CRC101

- Mobile phones off
- 85% attendance (includes tutorial sessions, excludes quizzes)
- Don't enter the class if more than 5 minutes late
- TAs take attendance in the first 5 minutes
- **Must** solve problems given in classes

- Basic circuit analysis (nodal/mesh analysis)
- Small signal incremental analysis
- Bode plots
- Two port parameters
- Circuit analysis with Laplace transforms

(Links to recorded lectures on the webpage)

- 4 quizzes-50 to 60%
- End sem-40%
- Problem sets on the course website-up to 10%
    - Must attend. Marks based on number of problems solved completely.

Post any questions related to the course on the moodle forum
TAs will be at: DSD lab(ESB 122) or VLSI group labs(CSD 204, 206)
Office hours will be announced

Simulate the circuits you see in class

- http://www.ee.iitm.ac.in/~nagendra/cadinfo.html
- Online spice simulator at
  http://www.ngspice.com/index.php

Build the circuits

- Breadboad, components, IE lab