

| Course Type | Course Code | Name of Course | L | T | P | Credit |
|-------------|-------------|------------------------------|---|---|---|--------|
| DC | NECC536 | Current Mode Analog Circuits | 3 | 1 | 0 | 4 |

Course Objective

The objective of this course is know the advantage of current mode circuit over voltage mode counterparts, different analog building blocks based on current mode approach and their applications in signal processing circuit and VLSI design and engineering.

Learning Outcomes

Upon successful completion of this course, students will:

- Introduction and comparison of current mode circuits over voltage mode counterparts.
- Trans-linear principle for current mode circuits along with concept of nullator and norator.
- Properties of different current mode analog building blocks utilizing BJT & CMOS techniques.
- Application of current mode approach in VLSI circuits.

| Module No. | Topics to be Covered | Lecture+Tutorial Hours | Learning Outcome |
|--------------|---|------------------------|--|
| 1 | Introduction to current mode circuits: Introduction, comparison of current mode circuits with voltage mode circuits | 7L+2T | Acquire an understanding of the current mode circuits and voltage mode circuits |
| 2 | Current mode circuits: Principle of operation, trans-linear principle, concept of nullator and norator, advantages, applications; Some current mode circuits: vector difference circuit, TL one quadrant squaring circuit, absolute value circuit, TL multiplier/divider. | 6L+3T | Understand the fundamentals, characteristics and trans-linear principle of Current mode circuits |
| 3 | Some BJT and MOS based current mode Building blocks: CCI, CCII, CCCII, CCCII (-IR), OTRA, internal structures, principle of operation; port relationship, analysis and applications; Multi-output current conveyors: Construction, advantages, applications | 11L+3T | Understand the functioning of BJT and MOS based current mode Building blocks and derive their characteristics with their applications. |
| 4 | Transconductance Amplifier: Internal structure and analysis, use of transconductance amplifier as variable resistance, inductance simulator, oscillator and filter, | 10L+3T | Understand the functioning of OTA, deriving their characteristics and their applications as filters and oscillators. |
| 5 | Non-linear applications: Schmitt trigger, multiplier; Operational Mirror Amplifier(OMA): principle of operation, applications as voltage controlled current source, current controlled current source, voltage controlled voltage source, current controlled voltage source, high CMRR instrumentation amplifier. | 8L+3T | Understand the use of current mode approach for designing and development of non-linear amplifiers. |
| Total | | 42L+14T | |

Textbook:

1. Analogue IC design : the current-mode approach by C. Toumazou, F.J. Lidgley & D.G. Haigh , Institution of Engineering and Technology, 2011.

Reference Books:

1. Current Feedback Operational Amplifiers and Their Applications, Senani, R., Bhaskar, D., Singh, A.K., Singh, V.K., Analog Circuits and Signal Processing, 2013.
2. Current-Mode VLSI Analog Filters: Design and Applications, Mohan, P.V. Ananda, Springer, 2003.
3. CMOS Current-Mode Circuits for Data Communications, Fei Yuan, Springer, 2007