Knowledge Network of
Indian Institute of Technology Gandhinagar
TEQIP-III Initiative (MHRD, Govt. of India & NPIU)

Online Short Course on
Design of CMOS Operational Amplifier ICs- A unique pedagogical approach

---

Date: 05/03/2021 to 11/03/2021 (6-days- excluding Sunday)
Mode: Online by IITGN
Target group: Faculty members

An operational amplifier (OPAMP) is one of the most important building blocks in many analog systems. The OPAMP is found in almost all electronic systems used in medical applications, industrial applications, consumer applications, environmental monitoring, communications etc. This building block is unique in that no other integrated circuit (IC) can be used in so many different applications and configurations. Besides providing application, the OPAMPS can realize a wide range of functions such as summing, buffering, subtraction, integration, differentiation, filtering, inversion and current to voltage conversion. The main parameters of an OPAMP are, (a) Differential gain, (b) Common mode rejection ratio (CMRR), (c) Linearity range, (d) Frequency bandwidth, (e) Slew rate, (f) Noise, (g) Power supply rejection ratio and (h) power dissipation. The OPAMP ICs are generally designed based on different architectures (Single ended, fully differential, Telescopic cascode, Folded cascode, Gain-boosted cascode, Rail-to-rail, Current-input etc.) to cater different needs of a particular analog system. It should be noted that none of these mentioned architectures can provide an OPAMP, which is good with respect to all the above-mentioned parameters. For example, it is difficult to have higher differential gain and lower power dissipation simultaneously or higher differential gain with adequate stability.

So, in summary, it is tricky to design an OPAMP IC for some given specification with a particular architecture. However, like any other analog ICs, the analog designer needs to develop skills to design a CMOS based OPAMP IC. Note that in analog circuits, the signal is transferred from input node to output node through intermediate nodes. The efficiency of signal transfer (which controls the device specifications) depends on the resistance and capacitance at every node. So, for proper design, one needs to understand this signal transfer process between input and output nodes. In this course, we will discuss a unique pedagogical approach, which will make the overall CMOS amplifier design process simple and interesting.

Course Coordinator- Prof. Nihar Ranjan Mohapatra (IIT Gandhinagar)