Tutorial Abstract –

Analog / Mixed Signal Design has been a subject of interest for a very long time. In general the real world is analog , so whatever we sense of interface with real world there will be Analog and Mixed Signal processing. Historically for most of the applications bipolar based designs was most popular because of it suitability for performance. However from the time of sub-micron technologies it was observed that we can possibly accomplish more processing at lesser area and power by Digital solutions. This led to a dramatic development of deep-sub micron CMOS , which eventually led the platform for System of chip (SOC) . On the way Analog/Mixed Signal Design bifurcated into two primary segments - one for catering to high performance / high volume standalone chips which continued to be developed in Bipolar or BiCMOS technologies. Other stream which developed analog for SOC, which was mostly in CMOS that kept its scaling down journey by means of technology innovations. Now while SOC technologies were friendly for Digital CMOS design , it was not necessarily always friendly for AMS designs. Hence came several challenges and with that several innovations which tackled these problems. AMS Design evolution with deep submicron or nano-meter technologies was based on two fundamentals - one innovations around technology , and the other was innovations around system level solutions. For example, if one has to deal with higher leakage from the relatively lower threshold voltage devices you can think of solving it by adding an extra mask (or modify a certain mask) or have a system solution to ensure extra leakage do not cause harm to the overall product. As we entered the era of FinFET the problems galore even further , while on the design level you now need to deal with lower supply voltage where conventional analog techniques of cascoding to get better gain suffers. Hence modification of architectures. Another example is to deal with layout techniques where metals are not allowed to move in any direction , they comes with restrictions and therefore conventional techniques like coaxial shielding do not get allowed. As we now move a step forward to Gate - All - Around (GAA) in sub 20 Angstrom nodes , the trend of challenges builds up further , where the thick gate oxide which was a huge help for Analog amplifier designs gets taken off. That brings the challenges of reliability with high voltage stress. Overall its been a fascinating journey of three decades from Submicron CMOS to Sub Angstrom SMOC AMS Design. Today and the roadmap ahead is going to blur the boundary between Analog and Digital even further. In this tutorial we'll talk about past , present and future of AMS CMOS Design.

Speaker's biography –

Mrinal Das is a semiconductor Industry veteran with more than 27 years of experience and a specialization for Analog/Mixed-Signal/RF product designs for diverse technology applications. He presently heads Hardware Development group Global R&D team for Synopsys with a focus on Silicon Lifecycle monitoring IPs for latest CMOS technologies. Within Synopsys, Mrinal is also member of core team for Synopsys Academic Research Alliance program worldwide and a member of the founding team for Synopsys Bhubaneswar branch. Prior to Synopsys, Mrinal co-founded Sankalp Semiconductor and served as Vice President and Board of Director while scaling the company from scratch to 1000+ people. Sankalp was an Industry leader for Mixed-Signal/RF chip design solutions from India and was acquired by HCL Technologies in 2019. Mrinal's early works in semiconductor industry was on chip developments with Texas Instruments in areas like Voice band modem, Cable modem, Digital Still Camera, Wireless LAN, Bluetooth etc. He has worked on several high-end RF transceiver SOC chips and successfully scaled up to production volume with niche customers. Mrinal loves to work with both Industry and academia with a deep passion to bridge the gaps between technology skill to sustainable revenue.