# CMOS ALL-Digital and Subsampling Phase-Locked Loops

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## Overview

Phase-locked loops (PLLs) are used to provide the clock frequency in almost every system-on-chip (SoC) microprocessor, radio-frequency integrated circuits (ICs), high-speed links for Input/Output (I/O) interfaces, etc. The performance of the SoC is severely impacted by the signal integrity of the clock. Therefore, the design of the PLL is significantly challenging. A PLL designer needs to have an understanding of the system specifications such as jitter and phase noise, spurious emissions and power supply sensitivity. This demands a knowledge of analog circuits, digital circuits, mixed-signal circuits, and control systems.

Traditionally, analog-intensive PLLs that employ high-performance charge pump and passive low pass filters have been used for most of the above applications. However, with CMOS scaling, design of analog circuits like charge pumps have become challenging. Furthermore, low pass filters occupy significant die area and suffer from effects such as leakage and variation. All-digital PLLs (ADPLLs) and Subsampling PLLs have now emerged as two popular alternatives. ADPLLs are compact, suitable to scaled CMOS processes, and easily portable across different generations of CMOS processes. Subsampling PLLs are also digital friendly, and have excellent noise performance.

The focus of this course is to enable the students to learn the concepts behind ADPLLs and Subsampling, and to acquire the ability to design and simulate them using industry-standard tools.

Course participants will learn these topics through lectures and simulation experiments. Also case studies and assignments will be shared to stimulate research motivation of participants. participants.

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| **Course Information** | **Dates – 12th to 16th Dec, 2022**<br>**CMOS All-Digital and Subsampling PLLs** |
| **You Should Attend If…** | ▪ you are an electronics engineer or research scientist interested in designing Phase Locked Loops as part of a wireless or wireline system.<br>▪ you are an engineer interested in learning about applications of PLLs in your profession.<br>▪ you are a student or faculty member of an academic institution and are interested in learning how to pursue research on PLL design or want to work with PLLs as part of a bigger electronic system.<br>**Number of participants for the course will be limited to fifty.** |
| **Fees** | The participation fees for taking the course is as follows:<br><br>**Participants from abroad : US $ 500**<br>**Students : INR 1000**<br>**Faculty : INR 5000**<br>**Industry / Research Organizations : INR 30000**<br>**Government Organizations : INR 10000** |

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| | The above fee include all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges, 24 hr free internet facility.<br><br>**Modes of payment:**<br>Online transfer: Click here to pay: https://elearn.nptel.ac.in/gian/ |
| **Accommodation** | The participants may be provided with hostel accommodation, depending on availability, on payment basis. Request for hostel accommodation may be submitted through the link: http://hosteldine.iitm.ac.in/iitmhostel/ |
| **Registration Procedure** | Please follow the following steps for the registration:<br><br>1. Go to GIAN website (http://www.gian.iitkgp.ac.in/GREGN/index) First time users need to register and pay a one-time fee of INR 500 /<br><br>2. Enroll for the course: Metocean Science and Engineering. Once you enroll for the course, an Enrollment/Application number will be generated, and the course coordinators will be notified. |

# The Faculty

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|  | **Dr. Sudip Shekhar** is an Associate Professor in the Department of Electrical and Computer Engineering at the University of British Columbia. His research interests include circuits for high-speed interfaces, silicon photonics, radio-frequency transceivers and sensor interfaces. |
|  | **Dr. S. Aniruddhan** is an Associate Professor in the Department of Electrical and Computer Engineering at the Indian Institute of Technology Madras, India. His research interests include circuits for RF and millimeter wave transceivers, and frequency synthesizers for wireless systems. |

# Course Co-ordinator

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