Title: **Analog Frequency Synthesizers: A Short Tutorial**

Abstract:

Phase-locked loop (PLL) circuits are a key component of most modern communication circuits, and are also used in a variety of digital processor applications in order to generate high frequency, low jitter clock sources. This tutorial-level presentation will present an overview of analog frequency synthesizers, including basic concepts and recent innovation. Classical integer-N synthesizers will first be examined in order to provide background on basic PLL components, modeling, and system level tradeoffs. Fractional-N synthesizers will then be presented along with key concepts in Sigma-Delta modulation. Finally, high level design and simulation techniques are presented, as well as results from an example implementation.

** Second Talk (roughly one hour) ***

Title: **High Performance Digital Fractional-N Frequency Synthesizers**

Abstract:

Digital phase-locked loops provide many implementation advantages compared to their analog counterparts by avoiding large capacitors for loop filters and the complications of designing analog-intensive components such as charge pumps. A key question, however, is whether such digital structures can support high performance applications in which low jitter and high PLL bandwidth is required? In this talk, we address this question by discussing techniques to achieve high performance digital fractional-N synthesizers, including high resolution time-to-digital conversion, digital quantization noise cancellation, and low-jitter divider structures. Measured results of a prototype will demonstrate that <300 fs of rm jitter can be achieved with a relatively high PLL bandwidth of 500 kHz.

Bio:

Michael H. Perrott received the B.S. degree in Electrical Engineering from New Mexico State University, Las Cruces, NM in 1988, and the M.S. and Ph.D. degrees in Electrical Engineering and Computer Science from Massachusetts Institute of Technology in 1992 and 1997, respectively. From 1997 to 1998, he worked at Hewlett-Packard Laboratories in Palo Alto, CA, on high speed circuit techniques for Sigma-Delta synthesizers. In 1999, he was a visiting Assistant Professor at the Hong Kong University of Science and Technology. From

1999 to 2001, he worked at Silicon Laboratories in Austin, TX, and developed circuit and signal processing techniques to achieve high performance clock and data recovery circuits.

He was an Assistant and then Associate Professor in Electrical Engineering and Computer Science at the Massachusetts Institute of Technology from 2001 to 2008. He was with SiTime Corporation from 2008 to 2010, where he developed key technology for MEMS-based oscillators. He was a professor at Masdar Institute in Abu Dhabi from 2011 to 2013, where he focused on low power, mixed-signal circuits for health monitoring. He is currently at Silicon Laboratories in Nashua, New Hampshire.