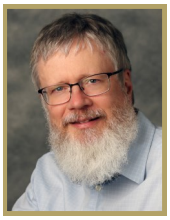
Georgia Electronic Design Center
Distinguished Lecture Series

When Optics met Digital Signal Processing; a Love Story.

F E A T U R I N G

Tuesday, January 17, 2023
11:00 a.m. to 12:00 p.m. EDT
Location: TSRB 118 Auditorium

Pizza & Soda Available Post Seminar



Kim Roberts
Vice President
WaveLogic Science
Ciena

Dr. Ian Roberts
DSP Engineer
Ciena

Abstract: Control and Information Theories added spice to the marriage. Teams of analog and digital CMOS designers and firmware coders delivered the progeny that now transport 800 Gb/s signals across optical fiber networks around the world. Ian Roberts, of Ciena Alpharetta, and Kim Roberts, of Ciena Ottawa, will describe the challenges and some of their solutions that have created the Digital Coherent revolution in high capacity optical communications. Then they will outline the opportunities to push against daunting physical limits and create the next generation of transmission system that will carry more information even greater distances, to achieve lower cost and lower heat per cat video transported. Chromatic dispersion in optical fibers is a change in the velocity of light as a function of frequency. This smears each transmitted symbol on top hundreds of its neighbors. Because of the Kerr nonlinearity in glass, amplitude variations create optical phase shifts which are expressed as self-phase and cross-phase degradations of the communications signal. Semiconductor lasers are compact sources, but have wide phase-noise spectra which complicates tracking of the signal phase in a receiver. Optical components have polarization dependent loss or gain. Optical fibers create differential delay between polarizations, that changes with the mechanical orientation of the cable. Lightning strikes can create large transients in the polarization orientation. Optical fibers lose half of the transmitted power after 15km. Optical amplifiers are used to overcome this loss across about 5 or 10 THz of optical spectrum, but inevitably contribute optical noise. These effects create 30 billion errors per second in the decoded signal which all need to be corrected. Users of internet services continue to demand twice as much capacity every two years. In many networks, greater spectral efficiency is required as that optical spectrum is getting full. 115 GHz analog sampling and 800 trillion integer operations per second are implemented in the fifth generation modem, WaveLogic-5e, to mitigate these issues.

"Digital-Coherent Revolution in High-Capacity Optical Communications"

Biography: Kim Roberts has been a major force in the field of digital signal processing for optical transmission in developing the first coherent 40, 100, 400, and 800 Gb/s optical systems. Today Kim is Vice President at Ciena, leading an R&D team focused on pushing the optical boundaries even further with WaveLogic-6. Kim is a passionate evangelist of new optical technologies and holds more than 190 patents with many more pending. Kim was named an IEEE Fellow, a Nortel Fellow, and in 2008 the Outstanding Engineer by IEEE Canada. Kim is the 2019 recipient of the Tyndall Award. Kim resides in Canada and can be reached at kroberts@ciena.com.

Biography: Dr. Ian Roberts completed his PhD on optimization of nonlinear optical fiber networks at Stanford. At Ciena he created a popular constellation morphing demo first shared at the Optical Fiber Conference, carrying uninterrupted traffic at 35 billion symbols per second during constellation transformations. More recently, he has implemented nonlinear probabilistic amplitude shaping and DSP for 800 Gb/s and beyond optical systems. Ian resides in Sandy Springs, Georgia and can be reached at iroberts@ciena.com.

Hosts: Stephen Ralph & Nima Ghalichechian