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KEYNOTE SPEAKER

Ultrafast Photonics Techniques and Applications - Communication and Signal Processing at the Speed of Light-

The development of high speed communication, interconnects and signal processing are critical for an information based economy. Lightwave technologies offer the promise of high bandwidth connectivity from component development that is manufacturable, cost effective, and electrically efficient. The concept of optical frequency/wavelength division multiplexing, i.e., using many different laser colors for transmitting information, has revolutionized methods of optical communication; however the development of optical systems using 100's of wavelengths present challenges for network planners. The development of compact, efficient optical sources capable of generating a multiplicity of optical frequencies/wavelength channels from a single device could potentially simplify the operation and management of high capacity optical interconnects and links. Over the years, we have been developing "mode-locked" semiconductor lasers to emit ultrashort optical pulses at high pulse repetition frequencies for a wide variety of applications, but geared toward optical communication using time division multiplexed optical links. The periodic nature of optical pulse generation from mode-locked semiconductor diode lasers also make these devices ideal candidates for the generation of a multiplicity of high quality optical wavelengths, or "optical frequency combs", in addition to the temporally stable, high peak intensity optical pulses that one is accustomed to. These optical frequency combs enable a variety of optical communication and signal processing applications that can exploit the large bandwidth and speed that ultrafast optical pulse generation implies, however the aggregate speed and bandwidth can be achieved by spectrally channelizing the bandwidth, and utilize lower speed electronics for control of the individual spectral components of the mode-locked laser. This presentation will highlight our recent results in the generation of stabilized frequency combs, and in developing approaches for filtering, modulating and detecting individual comb components. We then show how these technologies can be applied in signal processing applications such as arbitrary waveform generation, arbitrary waveform measurement, laser radar and matched filtering for pattern recognition.

Biography

Peter J. Delfyett received the B.E.(E.E.) degree from The City College of New York in 1981, the M.S. degree in EE from The University of Rochester in 1983, the M. Phil and Ph.D. degrees from The Graduate School & University Center of the City University of New York in 1987 and 1988, respectively. His Ph.D. thesis was focused on developing a real time ultrafast spectroscopic probe to study molecular and phonon dynamics in condensed matter using optical phase conjugation techniques. After obtaining the Ph.D. degree, he joined Bell Communication Research as a Member of the Technical Staff, where he concentrated his efforts towards generating ultrafast high power optical pulses from semiconductor diode lasers, for applications in applied photonic networks. Some of his technical accomplishments were the development of the world's fastest, most powerful modelocked semiconductor laser diode, the demonstration of an optically distributed clocking network for high speed digital switches and supercomputer applications, and the first observation of the optical nonlinearity induced by the cooling of highly excited electron-hole pairs in semiconductor optical amplifiers. While at Bellcore, Dr. Delfyett received numerous awards for his technical achievements in these areas, including the Bellcore Synergy Award and the Bellcore Award of Appreciation. Dr. Delfyett joined the faculty at the College of Optics & Photonics and the Center for Research and Education in Optics and Lasers (CREOL) at the University of Central Florida in 1993, and currently holds the positions of University of Central Florida Trustee Chair