THE DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING PRESENTS:

PROFESSOR HOSSEIN TAHERI

MINIATURIZED SOURCES OF ULTRASHORT OPTICAL PULSES AND HIGH SPECTRAL PURITY MICROWAVE SIGNALS

ABSTRACT

A train of ultrashort optical pulses is comprised of a large number of laser tones oscillating synchronously. This equally-spaced array of frequencies, called an optical frequency comb, has found applications in the generation of high spectral purity microwave signals, sensing and spectroscopy, calibration of astronomical spectrograms and search for exoplanets, timekeeping and the most accurate clocks, self-driving cars and LIDAR, and the precise measurement of some of the fundamental physical constants of the universe. Owing to its far-reaching applications, the frequency comb technology was recognized by the 2005 Nobel Prize in Physics. While optical frequency combs were originally realized by femtosecond mode-locked laser sources, in the past decade their demonstration in micron-scale and chip-based optical resonators made from Kerr-nonlinear materials bears the promise of simplifying their various applications and increasing their versatility by making them available at significantly reduced cost, size, and weight. The goal of my research is to provide a fundamental understanding of the process of frequency comb formation in nonlinear media and addressing the practical challenges posed by platform miniaturization in microresonator-based optical frequency comb (microcomb) generation. In this talk, I will highlight my research on the deterministic generation of stable ultrashort pulses (temporal solitons) in integrated photonic platforms, wavelength-specific engineering of microresonator structures for broadband microcomb generation, and innovative techniques for addressing the long-standing problem of stabilization of small-bandwidth microcombs for low phase noise radio-frequency (RF) signal generation and use in optical atomic clocks. I will also talk about some new directions of research in my lab at UC Riverside geared towards using frequency combs for early diagnosis of medical complications in the eye.

BIOGRAPHY

Hossein Taheri is an assistant research professor in the Department of Electrical and Computer Engineering at the University of California, Riverside (UCR). His areas of interest and expertise include nonlinear and ultrafast optics, synchronization phenomena and nonlinear dynamics, integrated photonics, and optical techniques for medical diagnosis. Prior to joining UCR, he was an R&D engineer at Foxconn Interconnect Technology in San Jose CA, working on optical transceivers with a pioneering team which was previously part of organizations known as Avago Technologies (now Broadcom Inc.), Agilent Technologies, and Hewlett Packard (HP) Optical Communications Division. Since 2017, he has also been a consulting scientist with Bioxytech Retina, a startup based in the San Francisco Bay Area. In 2016, he was a research scientist at OEwaves Inc. in Pasadena CA, a JPL NASA spin-off company focused on microwave photonics products and the first to commercialize frequency comb generation in high-Q optical microresonators. He received his master's and Ph.D. degrees in electrical and computer engineering with minor in physics at the Georgia Institute of Technology in Atlanta GA, and his bachelor's degree in electrical and computer engineering at the University of Tehran. His Ph.D. work focused on frequency comb and ultra-short pulse generation in optical microresonators with Kerr nonlinearity and on integrated photonic devices for on-chip optical data processing.

OCTOBER 1, 2018

WCH 205/206

11:10 A.M. - 12:00 P.M.

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