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Title: Ultra-Stable and Ultralow-Noise Mode-Locked Fiber Lasers and Their Applications

Abstract: Lower-noise and higher-stability mode-locked lasers and frequency combs are becoming more important and useful sources for a variety of applications ranging from precision spectroscopy to photonic signal generation and processing. In particular, all-fiber-based sources have clear advantages such as low cost, alignment-free operation, lightweight, and long-term stability. In this talk, I will overview our recent progress in realizing ultra-stable and ultra-low-noise mode-locked fiber lasers and their emerging applications. The scope includes (a) robust and low-noise polarization-maintaining mode-locked fiber lasers, (b) sub-femtosecond-resolution timing detection and synchronization between mode-locked laser and microwave, (c) all-fiber-photonics-based timing stabilization to 10^-14-level frequency instability and 1-fs jitter over 1-s, (d) low-noise and agile all-fiber-photonic X-band microwave synthesizers, (e) femtosecond-stability timing and synchronization between lasers and RF sources for ultrafast electron diffraction (UED) systems, (f) stable remote RF phase transfer over fiber and free-space links, (g) ultra-sensitive and high dynamic range strain sensing and dimensional metrology based on precise time-of-flight detection, and (h) highly tunable repetition-rate multiplication using harmonic injection locking. With rapid progress in both robustness and noise performances in mode-locked lasers, we anticipate that many new applications can be further explored in the coming years.

Short Bio: Jungwon Kim received the B.S. degree in electrical engineering from Seoul National University, Seoul, South Korea, in 1999 and the S.M.
and Ph.D. degrees in electrical engineering and computer science from the Massachusetts Institute of Technology (MIT), Cambridge, MA, USA, in 2004 and 2007, respectively. From 1999 to 2002, he was a Development Engineer at FiberPro, Inc. From 2007 to 2009, he was a Postdoctoral Associate with the Research Laboratory of Electronics (RLE), MIT. In 2009, he joined the faculty of the Korea Advanced Institute of Science and Technology (KAIST), Daejeon, South Korea, where he is now an Associate Professor of Mechanical and Aerospace Engineering.

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