



先端光量子科学アライアンス談話会・光量子科学研究センターセミナー・フotonサイエンス研究機構セミナー・
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フotonサイエンス・リーディング大学院・東京大学統合物質科学リーダー養成プログラム
最先端融合科学イノベーション教育研究コンソーシアム (CIAiS)

“Analog Gearbox”

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日時：平成28年12月2日(金) 13:30-15:00

場所：東京大学理学部1号館3階338号室

Abstract

Inspired by the mechanical gearboxes we introduce its analog implementation in optics. The gear box matches the speed of fast optical data with the slower speed of electronics enabling single shot measurements at billions of frames per second. Functioning as a photonic hardware accelerator the gearbox reshapes the spectrotemporal evolution of a wideband streaming signal based on signal's local entropy. Nonlinear group delay dispersion modes have been developed as mathematical building blocks for such transformations. Representing spectrotemporal basis functions, these modes and their corresponding time-stretch wavelets have distinct and useful properties that depend on their symmetry. We show how these photonic computational primitives reshape the wideband signal to enable nonuniform sampling, data compression, and pattern recognition in real-time. Additional applications including coding, signal classification, and enhancement of signal-to-noise. This talk will start with an overview of Photonic Time Stretch and its applications in the discovery of optical rogue waves, the first observations of the birth of mode-locking, relativistic electron bunching in synchrotrons, single shot stimulated Raman spectroscopy of chemical bonds. The recently reported marriage of time stretch with artificial intelligence for label-free detection of cancer cells in blood will be described. The talk will conclude with the Phase Stretch Transform, an optics-inspired digital algorithm that is advancing super-resolution microscopy and medical imaging.

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