Title:

Single-Photon Avalanche Diodes and their use in Time-of-Flight Applications

Abstract:

Single-photon avalanche diodes (SPADs) implemented in CMOS technologies offer a unique combination of high photon sensitivity and ultra-fast timing accuracy, along with the ability to be integrated alongside high-speed readout, signal processing and power management circuitry. This talk will introduce a fully industrialized SPAD device and its implementation and state-of-the-art performance in STMicroelectronics advanced 40nm CMOS technology node. These have been used to produce fully integrated, direct time-of-flight (ToF) products for the consumer market, positioning STMicroelectronics as the worldwide number one supplier of ToF devices. Such devices provide an all-in-one ToF solution, featuring on-chip SPAD array, signal processing and laser driver alongside an in-module VCSEL. A view on how such devices could be adapted for longer range applications such as LiDAR will also be offered.

Biography:

Bruce R. Rae is a Photonics Pixel Architect within the Imaging Division of STMicroelectronics, Edinburgh, UK. In this role, he works in close collaboration with the silicon, process, module and system R&D teams to define and develop the Imaging Division photonics pixel roadmap and specification. He also works with external collaborators on advanced R&D projects and acts as an industrial advisor for several national funding bodies and international research consortia. Prior to taking up his current role, Bruce was a Technical Project Manager and Analog Design Engineer at STMicroelectronics. He also spent two years as a Post-Doctoral Research Associate at The University of Edinburgh. Bruce obtained MEng and Ph.D. degrees in Electrical and Electronic Engineering from The University of Edinburgh, UK (2005, 2009). He has authored or co-authored over 40 papers in international journals and conferences and holds several patents in the field of image sensors and time-of-flight detectors. He is a current member of the Technical Program Committee for IEEE ISSCC.