North American Workshop on Silicon Photonics for High Performance Computing

May 17-18 2018, Fort Collins, CO

Is it possible to obtain high bandwidth density with present modulators in mature 300mm silicon photonics platform?

J.F Carpentier
STMicroelectronics
jean-francois.carpentier@st.com

Abstract

Optical technologies are emerging as attractive solutions to perform short range communications, suitable for instance to connect the cores (CPU/GPU) and the multiple memory resources. Such optical links can solve bottlenecks like number of channels and /or increasing data rate for HBM and HMC based-systems respectively.
O-band SOI-based silicon photonic interposer technology is now available from state-of-art CMOS facilities on 12" wafers for 4x25Gb/s. Hybrid integration approach using face-to-face die stacking were qualified, driven by the market of front-panel modules with the introduction of Parallel Single Mode (PSM) fiber optic solutions.
To address chip-to-chip communications, two main topics would be solved like qualification of larger silicon interposer and low foot-print & low-power modulators. The first one is on the industrialization road through the GPU card market, with 800mm2 passive silicon interposer vertically interconnected by TSVs to BGA substrate for example. We propose to describe silicon carrier-depletion Mach-Zehnder and ring modulator optimizations done to go ahead on the second one.

Bio –

Jean-François Carpentier received the Ph.D. degree in electrical engineering in 1994 from the University of Lille (IEMN Laboratory), France, for his thesis on electromagnetic solvers to study interconnections in MMIC. From 1995 to 1997, he was an Assistant Professor, engaged in frequency domain numerical techniques for 3-D electromagnetic simulations. In 1997, he joined STMicroelectronics, Central R&D, Crolles, France. He developed electromagnetic simulations activity for passive components and interconnections for RF, analog, and digital applications on silicon. He became an expert in simulation, modeling and characterization of Si-passive components and interconnections. In 2002, he moved to RF design with MEMS, especially with bulk acoustic wave resonators. He was engaged in research and development on RF circuits and BAW devices for mobile communications. In 2005, he has been with the Passive and RF-MEMS Above IC group, and he managed a group on filtering with BAW resonators, including modeling, RF characterization, and filter designs. In 2010, he joined R&D process development group as team manager to develop integration of heterogeneous systems on silicon interposers, with special interest on 60GHz module with beam-forming in WiGiG context to provide Gbit/s data transfer. Since 2012, he was engaged in a new More than Moore activity inside STMicroelectonics relative to photonics. He was in charge of testchips specification, design and characterization to qualify the technology. In 2012, he was graduated of "Habilitation à Diriger des Recherches" at Grenoble INP.