Invited

Silicon Nanophotonics for Optical Interconnects

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The semiconductor industry followed an unprecedented growth in productivity over the last four decades. This resulted in an ever decreasing reduction of chip cost and lead to pervasive penetration of microelectronic components into all sectors of the commercial and consumer space. Technology and manufacturing capabilities are honed to the extreme to meet the expectations of the market in cost and performance. Taking advantage of this infrastructure is the goal of integrated silicon photonics. Traditionally photonic components are put together with heterogeneous components, like modulators, detectors, lasers, etc, each one optimized for its purpose. The long haul telecommunication space was the early adopter of this technology to support high data rates across long distance connections. The number of systems was relatively small and a cost premium for achievable performance was acceptable. As the appetite for higher data rates also moves to the shorter distances and the number of photonic components dramatically increased cost and performance needed to be balanced. Integrated silicon photonics with its fundamental roots in the semiconductor industry provides a platform to address this trade-off. The growing market for large-scale datacenters and high performance computing systems creates a demand for economical, low-power optical links capable of transmitting high-bandwidth traffic over moderate distances from a few meters up to 2km. By leveraging existing CMOS infrastructure and the cost benefits of monolithic integration, silicon photonics technology can provide single-mode, wave length division multiplexed (WDM) interconnects that fulfill the stringent requirements of these next-generation systems. As this technology matures, silicon photonics-based optical links can expand to several additional markets, from metro applications requiring 2-5 km of reach to optical backplane links as short as a meter. We will give a short introduction into the basic elements of an optical link and then discuss how these can be incorporated into a monolithic silicon solution.