Miniaturization and Integration of Micro/Nano-Photonic Devices for Optical Printed Circuit Board (O-PCB) and VLSI Photonic Applications

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Abstract: We present the results of our study on the miniaturization, interconnection and integration of micro/nano-scale photonic devices and polymer optical waveguide arrays and circuits for application to a newly conceived module that we call “optical printed circuit board (O-PCB)”, which may be used as a platform for VLSI micro/nano-photonic integration. We use embossing techniques to fabricate planar circuit arrays of polymer optical devices and waveguides of various functions and dimensions in the micro/nano-scale. The O-PCBs are designed to perform the functions of transporting, switching, routing and distributing optical signals on flat modular substrates or boards. It contrasts with the electrical printed circuit boards (E-PCBs) which are designed to perform electrical functions only. The O-PCBs can be combined with the E-PCBs for enhanced performances of both functions. We examine the issues and considerations for the design and implementation of the O-PCBs and discuss the issues and challenges for the miniaturization, interconnection, and integration of photonic devices and waveguides on the micro/nano/quantum scale to put them together on the O-PCB boards. Some examples will be given with a special attention on the potential role of the O-PCB as a vehicle for VLSI micro/nano-photonic applications in telecommunications, computers, automobiles, and others.

Biography: Professor El-Hang Lee received the Ph.D. in Applied Physics from Yale in 1977 under the guidance of Profs. R. K. Chang (Henry Ford II Professor) and J. B. Fenn (Nobel Laureate, 2002). Prof. Lee conducted research and management for 30 years at Yale, Princeton, MEMC, AT&T Bell Labs., and ETRI and has published more than 210 international refereed archival journal papers, has given over 320 worldwide presentations and over 50 plenary, keynote, and invited talks in international conferences on semiconductor electronic and photonic devices, optoelectronics, photonics and optical communication. Prof. Lee is a Fellow of the IEE (UK), IEEE (USA), OSA (USA), KAST, KPS, and IEEK (Korea) and the recipient of more than 15 national and international awards. Prof. Lee has served many times as the chair, committee member, and advisor in international conferences and meetings. He is the founding Director of the m-PARC and the OPERA National Research Center at Inha. Prof. Lee was the Vice President of OSK, the founding President of the IEEE-LEOS Korea Chapter (Best Chapter in 1996) and the founding director of the SPIE-Korea Chapter. He is also the Co-chair of the KAPA (Korea-Australia Photonics Association) established in 2000 between Korea and Australia.