Complex Reconfigurable Free-space Optical Interconnections Via Phase CGH in Spatial Light modulators

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The non-interfering free-space optical interconnections possess the advantages of higher throughput and less delay time compared to electronic interconnections. The free-space interconnection technique can be applied to single chip or wafer and between chips or modules. Recently, real-time reconfigurable optical interconnections techniques have been developed for optical computing, neural network, and optical communications using spatial light modulators(SLMs) with computer-generated holograms(CGHs). However, most of the present approaches could only realize simple configurations such as the one to many and regular array interconnections. In this paper, we present a complex reconfigurable complex optical interconnections technique based on the writing of phase CGHS on SLMS. A higher efficient multiple-beam splitter(MBS) is generated via a SLMS by means of the optimization of phase CGHs. For example,we assume the input has N units or processing elements. The input laser beam is divided into N parts to illuminate N different long strips of SLM. Each strip of the SLM is recorded with a phase-modulated CGH which can generate a 1xn (n=1,2,...N) MBS on the focal plane of a cylindrical lens. So that, such N different areas may form N individual MBSS. An additional cylindrical lens is used for combining the outputs of the N channels. Each output unit resulted from the combination of the N channels form the different interconnections weights of the system. The applications of the complex reconfigurable optical interconnection technique to

implement crossover, crossbar, shuffle, non-regular array, neural network, and the maps of residue arithmetics are presented,

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