Optoelectronic Multi-Chip Modules Based on Imaging Fiber Bundle Structures

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Abstract. Recent advances in optoelectronic (OE) devices and in processing technology have focused attention on the packaging of multi-chip optoelectronic systems. Alignment tolerances and geometrical restrictions often make the implementation of free space optics within these systems quite difficult. Critical alignment issues also characterize fiber-per-channel guided wave systems based optical ribbon cable or large core fiber arrays. In this presentation I will describe an alternative packaging technology based on imaging fiber bundles. In an imaging fiber bundle, each optical data channel is carried by multiple fibers. An array of spots imaged at one end of the fiber bundle is correspondingly imaged on the opposite end. In this manner, imaging fiber bundles are capable of supporting the spatial parallelism of free space interconnects with relaxed alignment and geometry constraints. We have demonstrated a 16-channel point-to-point link between two VCSEL arrays that were directly butt coupled to an imaging fiber bundle. No other optical elements were used in the setup. We have also investigated a number of multi-chip interconnection module designs using both rigid and flexible imaging fiber bundles. Our basic approach to multipoint interconnect is to fabricate structures in which individual regions of the image at the input surface of a fiber bundle (or a fiber bundle array) are passively routed to different output surfaces. Opto-electronic devices, such as flip-chip bonded GaAs on silicon can be mounted on metal traces plated on to each surface of the module. The resulting network provides for spatially resolved bidirectional channels between each of the OE chips.