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Optical phased array propagation in atmospheric channels and coherent beam combining

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Coherent beam combining in a turbulent atmosphere is a major challenge yet to be met. The advantages of combining several sources in a coherent manner are numerous. Among them are the propagating beam improved coherence, achieving smaller spot size, avoiding technical difficulties by spreading high optical power to several weaker emitters, and diminishing thermal blooming by spatially separating the emitters. In most cases, the coherent combining is performed before the combined beam is introduced to the turbulent atmosphere, or either it is performed by getting feedback regarding the relative phases from the target by *in situ* measurement. The concept presented here does not rely on receiving any information from the target. Modeling the process of atmospheric propagation is limited by today's computational power, the statistical nature of the analytical approaches and the reduced dimensionality of the phase screens approach. This work focuses on two goals. The first is the introduction of the sparse spectrum harmonic augmentation method for modeling the full 3D turbulent atmosphere. The second is the simulation proven concept of atmospheric channels, which are weakly guiding, and confining mechanisms caused by the refractive index of the atmosphere. These channels can be conceptually utilized for performing coherent beam combining in the turbulent atmosphere. In order to do so, we need to use an optical phased array with unique features, such as the ability to perform phase-controlled beam steering, phase sensing of returning backscattered radiation, time gating and individual phase control of each element of the array.

Biography

Itay Naeh is pursuing his PhD studies in the Applied Physics Group from Tel-Aviv University. During is PhD study he developed new methods for simulating propagation of lasers in turbulent atmosphere. Based on these simulations, he has established the concept of atmospheric channels and suggested a new approach for using these channels to perform coherent beam combining using an optical phased array. Currently, he works at Rafael, as a Research Fellow. His work was published in leading peer-reviewed journals.

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