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Laser Communication and Propagation through the Atmosphere and Oceans II

Alexander M. J. van Eijk
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Editors

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Introduction

This volume contains the papers submitted and accepted as full manuscripts following presentation at the second Conference on Laser Communication and Propagation through the Atmosphere and Oceans II. This new conference is the second in a series that combined previous conferences on Atmospheric Optics: Turbulence and Propagation, and Free-Space and Atmospheric Laser Communications. Free space optical (FSO) communication is now a mature field, but many exciting fundamental and technological challenges remain to improve its performance in a range of scenarios. The data rates provided by FSO links continue to increase in both long and short range applications. There continues to be great interest in simulations and experiments that characterize the optical properties of the turbulent atmosphere, including in seriously obscured conditions.

There is a need to simulate the effects of turbulence on imaging through the atmosphere. Because of anisoplanatism effects, the image-distorting effects of turbulent atmospheres vary over small angular changes, and adequate simulations become computationally expensive. Speckle imaging techniques can be used to improve the quality of images affected by atmospheric turbulence. Very long range terrestrial links through the atmosphere can experience severe scintillation caused by atmospheric turbulence, which presents significant challenges in beam pointing and leads to deep fades. Turbulence can even be used to induce interesting chaotic dynamics effects that can be analyzed by fractal techniques.

Pointing, acquisition, and tracking of narrow beams, whether FSO or RF remains an important issue. Forward error correction, interleaving, and packet-level correction codes can also improve the performance of FSO links. Clever transceiver implementations and the right modulation schemes show promise for improved link performance. Non-line-of-sight links using solar blind UV radiation scattered from transmitter to receiver open interesting communication scenarios.

FSO communication links are now being designed for different specialized scenarios. There is increased interest in the use of light emitting diodes for indoor communications, particularly for downloading of data, and in clever schemes like MIMO for improving their performance. Underwater optical communications can provide networking of sensors for monitoring water quality and the effects of climate change, as well as for short range data transfer. The use of directional radiofrequency communications as an alternative to FSO can improve link and network availability, and opens up interesting opportunities for network modeling. The interesting issues described above are addressed in papers published in this volume. A number of papers describe new characterization techniques for atmospheric transmission and measurement of the spectral characteristics of LED sources. At a fundamental level, several papers address modeling of the effects

of the atmosphere on propagating beam waves, using both wave optic and geometrical optic approaches, where atmospheric properties can be measured, and correlated with theoretical models describing phenomena such as obscuration, beam wander, scintillation and image motion.

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