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# Physical-Optics-Based Tolerance Analysis for Fiber Coupling Systems

## SPIE - Optical Modelling and System Alignment

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**Session 2: Optical Tolerancing and Verification**

**Paper authors:** Huiying Zhong<sup>1</sup>, Wenxiu Wang<sup>1</sup>, Site Zhang<sup>2</sup>, Christian Hellmann<sup>3</sup>,  
and Frank Wyrowski<sup>2</sup>  
<sup>1</sup> Applied Computational Optics Group, Friedrich Schiller University |  
Jena, Germany  
<sup>2</sup> LightTrans International UG | Jena, Germany  
<sup>3</sup> Wyrowski Photonics GmbH | Jena, Germany

### Abstract

Optical fibers are widely used for collecting and monitoring light signals in modern optical metrology systems. The use of fibers helps reduce the size of optical system and makes the interconnection between systems convenient. But on the other side, the design and analysis of systems containing fibers often go beyond traditional ray-optics modeling. Because the interaction between light and fibers, with core diameter only several micrometers, requires electromagnetic field solvers. In this work, we present a physical-optics-based modeling technique for the complete optical system, including large-scale lenses and micro-scaled optical fibers. We investigate the coupling of electromagnetic fields into fibers using different lens systems, and especially, we perform tolerance analysis of given system with respect to shift and tilt of the fiber, as well as other components in the system.