

LightTrans' Talks at SPIE Photonics West 2020

# Spatio-Temporal Simulation of Ultrashort Phenomena in Different Optical Systems

**SPIE LASE – Session 7: Advanced Ultrafast Laser Processing Techniques**

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When investigating ultrashort phenomena or applying ultrashort pulses as key technologies nowadays, people are no longer just interested in their temporal behavior and properties but have noticed the impact and possible advantage of the spatio-temporal effects. We will present our modeling concept including both temporal and spatial properties of ultrashort pulses based on physical optics. The modeling of the pulses starts with a temporal Fourier transform which convert the temporal signal into correlated spectral modes, so that the material dispersion effects can be included. Each spectral mode is polarized and therefore vectorial electromagnetic field information can be considered. Based on the concept of field tracing, we investigate the interaction of ultrashort pulses with different types of optical components, including lenses, mirrors, as well as diffractive gratings and even metasurfaces. As examples, pulse stretching/compression with gratings, high-NA focusing with parabolic mirrors, and scanning system with F-theta lenses will be presented. Spatio-temporal behavior of ultrashort pulses will be analyzed in all the examples.

