

Laser World of Photonics

Physical-Optics Simulation of Optical Interferometry Systems

Site Zhang¹, Huiying Zhong², Rui Shi², Christian Hellmann³, and Frank Wyrowski²

- ¹ LightTrans International UG, Jena, Germany
- ² Applied Computational Optics Group, Friedrich-Schiller-Universität Jena, Germany
- ³ Wyrowski Photonics GmbH, Jena, Germany

Jena, Germany



Optical Design Software and Services



Physical-Optics System Modeling by Connecting Field Solvers



Physical-Optics System Modeling: Regional Field Solvers



Physical-Optics System Modeling by Connecting Field Solvers

Connection of solvers via I/O channel concept which enables non-sequential physical-optics system modeling



Setting A



1st ×

X

2nd

Setting A







Setting A



1st	×
2nd	×

2nd

Setting A



Surface	+/+	+/-	-/-	-/+
1st	×			
2nd	×			

Setting B



 Surface
 +/+
 +/ -/ -/+

 1st
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×
 ×

Setting C

2nd



Х

Setting D



Setting E



Surface	+/+	+/-	-/-	-/+
1st	×	×	×	×
2nd	×	×	×	×

Parallel Planar-Planar Surfaces



Parallel Planar-Planar Surfaces



Constructive and destructive interference alternatively shows up when the thickness of etalon varies.

Tilted Planar-Planar Surfaces



Cylindrical-Planar Surfaces



Spherical-Planar Surfaces



Non-sequential field tracing simulation of etalons allows the consideration of arbitrary surface types. **Why Physical Optics?**

Why Physical Optics?



Why Physical Optics?

- Modern interferometers may use ...
 - ... advanced light sources
 - ... innovative optical components
 - ... different types of detectors
 - ... complex light paths



Field Tracing Enables Fast Physical Optics

Field Tracing comprises:

- Application of different electromagnetic field solvers in different regions of one system.
- Interconnection of any type of general and specialized field solver.
- Source mode concept to represent coherent, partially coherent, and incoherent sources.
- ... and many more techniques



Fizeau Interferometer for Optical Testing

Modeling Task



Tilted Planar Surface under Observation



Cylindrical Surface under Observation



Spherical Surface under Observation



VirtualLab Fusion Technologies





Coherence Measurement Using Michelson Interferometer and Fourier Transform Spectroscopy

Modeling Task



Lateral Interference Fringes – 50nm Bandwidth



Lateral Interference Fringes – 100nm Bandwidth



Pointwise Measurement



VirtualLab Fusion Technologies





LightTrans International UG

Mach-Zehnder Interferometer

Modeling Task



Interference Fringe Due to Component Tilt



Calculation of interference pattern including element tilt takes less than 2 seconds!



Interference Fringe Due to Component Shift



Calculation of interference pattern including element shift takes less than 2 seconds!



Polarization Interference

Modeling Task



Interference Pattern Changes with Polarizer Rotation



Interference fringes start to disappear, when polarizer rotates from parallel to orthogonal orientation.



Interference Pattern Changes with Polarizer Rotation





Interference Pattern



Examination of Sodium D Lines with Etalon

Modeling Task



Visualization of Both Spectrum Lines



LightTrans International UG

Finesse vs. Coating Reflectance



Finesse vs. Coating Reflectance



the higher reflectance, the higher finesse



extracting 1D data along the diagonal direction

VirtualLab Fusion Technologies





Optical Design Software and Services

