WYROWSKI
VirtualLab FUSION
FAST PHYSICAL OPTICS SOFTWARE

Fast – Accurate – Flexible

The Optical Simulation Software VirtualLab Fusion

Date and Training Courses:
15 – 16 April 2024 | Introduction to VirtualLab Fusion
18 – 19 April 2024 | Grating Simulations with VirtualLab Fusion

Note: It is possible to register for either of the two parts of the course, as well as for both of them together.

Location:
LightTrans USA L.P.
5126 South Royal Atlanta Dr
Tucker GA 30084, United States of America

First Some Basic Information about VirtualLab Fusion (VLF)
Before the hardware there often comes the software. First, test, check, analyze, investigate, design and optimize, then fabricate and construct. This is the typical workflow. But which software is best suited for one's purpose? Due to its unique software architecture, based on a groundbreaking theoretical foundation, VLF lends itself to almost unlimited use for optical simulations. Especially because we have focused on the most important aspects for our customers.

Navigating the delicate compromise between the accuracy of the results and the speed with which those results can be generated is an unavoidable part of simulation technology. The optical modeling and design software VLF provides its users with the necessary flexibility and control to strike the right balance between accuracy and speed every time, through its interoperability of modeling techniques on a single platform.

Be inspired by the enormous range of capabilities and possible applications of VLF:

- from nano to kilometer scale
- modeling of any existing light source (from X-rays to microwaves and beyond)
- consideration of diffraction, coherence, interference, polarization, energy conservation
- tailor-made modeling options for all kinds of optical scenarios
- customizable evaluation tools

for e.g.,

- interferometry
- fiber coupling
- meta gratings
- and more ...
- (micro) lens systems
- ultrashort pulses
- complex meta structures
- anisotropic media and birefringence
- light diffusing, splitting and shaping
- augmented and mixed reality waveguides

On the next pages we list the content of the two training courses. ▶

Introduction to VirtualLab Fusion (VLF)

This course is intended for both absolute beginners and advanced users who want to practice/expand the use of the new simulation concept “General Profile” or want to refresh their skills and learn a new functionality or two.

The necessary knowledge to be able to perform a variety of optical simulations will be taught. This is done by means of a selection of various use cases, which at the same time illustrate the wide range of application areas. Below you find a more detailed agenda of the topics and possible examples used to illustrate them:

Fast – Accurate – Flexible: First Contact and Evaluations

- Striking the correct accuracy-speed balance through interoperability of modeling techniques on a single software platform.
- Building your first optical system with VirtualLab Fusion.
- System building blocks. Simulation settings. Key aspects of VirtualLab Fusion technology.
- Light as an electromagnetic field. Our flexible detector modeling. Detector add-ons.

The New General Profile Simulation Engine

- The role of the Fourier transform in the simulation of diffraction.
  The catalog of algorithms for the calculation of the Fourier transform.
- Diffraction integrals. Analyzing what the selection of Fourier transform algorithms looks like in some typical configurations.
- Controlling the selection of Fourier transform algorithms. Automatic selection or tailored configuration. Switching diffraction on and off in your simulation (modeling of pinhole in system with low Fresnel number).

Positioning & Non-Sequentiality

- Positioning and orientation concepts and tools.
- Non-sequential simulations.
  The Light Path Finder. The channel concepts (modeling of an etalon, microlens array).

More Sophisticated Configurations

- Advanced positioning (experiments with a Mach-Zehnder – complementary interference pattern caused by prism beam splitter, observation of the Gouy phase shift, generation of spatially varying polarization).

Let VLF Do All the Algorithmic Connections

- Behind the scenes: palette of algorithms used, depending on selected optical elements (electromagnetic field solvers).
- Examples (Abbe’s image resolution experiment, optical system for investigation of microstructured wafer, birefringence in calcite block, crystals).

Source Modeling

- Advanced source modeling – the source mode concept.
- Coherence modeling (white-light Michelson interferometer, demonstration of working principle of optical coherence tomography, Young’s double-slit experiment with an extended source, ultra-short pulse through high-NA lens, Talbot effect with unpolarized light, VCSELs).

Throughout the Course

- Convenience tools (handling of 1D and 2D data, multigraphs, cross sections generation, parameter sweeps, parametric optimization, property browser, ...).
- Q & A

Please note that this agenda remains subject to change. The topics discussed as well as the order in which they are presented can be adjusted on the spot before or during the course, according to the dynamics of the group.

Grating Simulations with VirtualLab Fusion (VLF)

This course is intended for people who are already familiar with the basic usage of VLF (e.g., as taught in the introductory course), so that we can focus on the more specific grating topics. First, the base concept for grating modeling is covered, followed and accompanied by walking through examples of modeling and design of systems containing gratings and meta-structures.

Here, VLF shows its full strength by not only putting at your disposal the necessary tools for the evaluation of gratings as standalone components, but also, crucially, by providing, on a single software platform, rigorous modeling techniques for gratings alongside a rich catalog of numerical methods for other types of components. This, in effect, makes it possible to simulate complex optical systems with the necessary accuracy at optimum speed.

A brief introduction to our optimization document based on the iterative Fourier transform algorithm (IFTA) is also given, as this is a useful tool for preliminary work in a metastructure design.
Below you find a more detailed agenda of the topics and possible examples used to illustrate them:

Basic Tools and Techniques

- Grating configuration and modeling.
- The grating specific optical setup.
- Electromagnetic field solvers: thin element approximation (TEA) and Fourier modal method (FMM) also known as rigorous coupled wave analysis (RCWA).

Examples and Features

- Rigorous modeling examples for getting first impressions (e.g., Blazed grating for spectral separation).
- Field inside grating evaluation (e.g., Ultrasparse dielectric nano-wire grid polarizers).
- Special modeling approaches for non-mathematical height functions (e.g., Simulation and analysis of slanted gratings with varying parameters, volume holographic gratings and their sensitivity).

Gratings within Optical Systems

- Specialties of grating simulations within the general optical setup (e.g., angular-filter volume grating for higher diffraction order suppression).
- Using gratings as test objects in imaging systems (e.g., optical system for investigation of microstructured wafer).

Grating Design & Optimization

- Optimization of slanted gratings for waveguide coupling.
- Parametric optimization tool.
- Robustness optimization of slanted grating with the new Parameter Variation Analyzer (PVA).
- Further examples (e.g., design of polarization-independent high-efficiency gratings, design of antireflection moth-eye structures).

Metagratings and IFTA Intro

- Rigorous analysis of nanopillars as metasurface building blocks.
- Design of a blazed metagrating.
- Short introduction to iterative Fourier transform algorithm (IFTA) document and associated assistants for phase profile generation (e.g., diffractive beam splitter).

Metastructure Design and Q&A

- Example(s) (e.g., Beam-splitting metagrating design, Metalens).
- Q & A

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