SYNOPSYS®

DATASHEET

Complex Field Exchange

Leveraging CODE V, BeamPROP & FullWAVE for Accurate, End-to-End Diffraction Analysis

Features at a Glance

Key features of our common interchange format for sharing complex optical field data:

- Supports both scalar and vector fields
- Supports square and rectangular data grids
- Can be used for the beam input and saved as output for all products
- ASCII format allows interfaces to be written with customers' in-house software

Overview

Synopsys' Optical Solutions Group (OSG) products provide highly accurate, end-to-end analysis of diffraction-related characteristics and effects in an optical system.

CODE V®'s Beam Synthesis Propagation and the RSoft™ BeamPROP™ and FullWAVE™ products support a common interchange format to share complex optical field information. This allows the tools to easily communicate with each other and makes it easier for users to perform a full system diffraction analysis when multiple tools are required.

The interface supports scalar and vector fields and square and rectangular data grids. It can be used to provide beam input information and output results for all products. Its ASCII format allows interfaces to be easily developed with customer in-house software.

CODE V's Beam Synthesis Propagation

CODE V's Beam Synthesis Propagation (BSP) sets an industry standard for accurate, efficient, and easy-to-use beam propagation of optical systems, and free-space telecom devices. BSP's beamlet-based wave propagation algorithm includes proprietary enhancements designed to deliver extremely accurate and efficient modeling of diffracted wavefronts propagating through an optical system.

BSP represents the optical field as a collection of individual beamlets. A beamlet consists of a base ray and a field that is initially localized about the base ray. The base ray defines the reference location and direction for each beamlet. Based on the fact that the wave equation is linear, these beamlets are propagated independently and can be summed anywhere downstream to get the propagated optical field. This method can propagate beams through anything that can be ray traced.

Determining appropriate inputs for any beam propagation algorithm can be challenging. BPS's groundbreaking Pre-Analysis feature automatically recommends analysis settings based on your lens system and delivers an accurate answer in the shortest time possible.

The BSP algorithm accurately works for systems with feature sizes > 10λ. If the optical system is coupling light into a waveguide or a device with smaller features, the complex field exchange can be used to communicate the electric field to other OSG products such as BeamPROP and FullWAVE that work in this realm.

RSoft BeamPROP

BeamPROP is a simulation tool for the design of integrated and fiber-optic waveguide devices and circuits. The software uses an advanced finite-difference beam propagation (BPM) technique to simulate propagating light. BeamPROP is accurate for optical devices with all feature sizes. The complex field exchange can be used to communicate field data between CODE V's BSP and BeamPROP. Field exchange is also possible between all of the RSoft simulation software packages such as BeamPROP and FullWAVE. Due to the fundamental nature of the BPM algorithm, BeamPROP can simulate light that travels primarily in one direction. This is a valid assumption for most fiber and waveguide devices. OSG's FullWAVE can be used to simulate cases where this assumption does not hold.

RSoft FullWAVE

FullWAVE is a highly sophisticated simulation tool for studying the propagation of light in a wide variety of photonic structures, including integrated and fiber-optic waveguide devices, as well as circuits and nanophotonic devices such as photonic crystals. The software employs the Finite-Difference Time-Domain (FDTD) method for the full-vector simulation of photonic structures. Since it solves Maxwell's equations directly without assumption, FullWAVE is well-suited for any structure type and is not limited by any feature size or propagation direction. The complex field exchange can be used to communicate field data between CODE V's BSP and FullWAVE. Field exchange is also possible between all of the RSoft simulation software packages such as BeamPROP and FullWAVE. FDTD simulations are very rigorous and, as such, are usually limited to a small computational area.

Applications

Some applications of our common interface for sharing complex optical field data include:

- Focused beam coupling into a fiber or waveguide system
- CMOS
- Optical storage (reading a DVD/Blu-ray surface)
- Vector diffraction efficiency calculations using RSoft DiffractMOD

For more information about Synopsys' Optical Solutions Group, visit synopsys.com/optical-solutions/rsoft or email us at optics@synopsys.com.

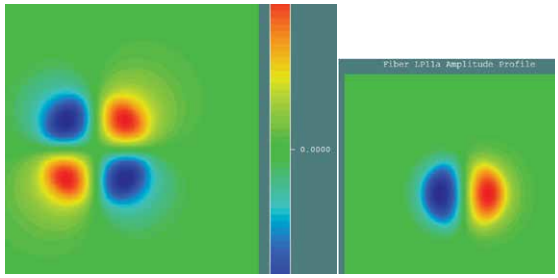

Figure 1: CODE V-generated complex fields

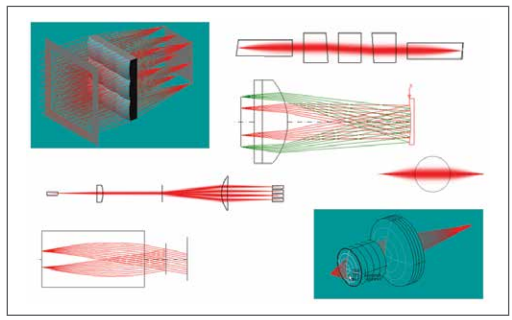

Figure 2: Photonic system models in CODE V

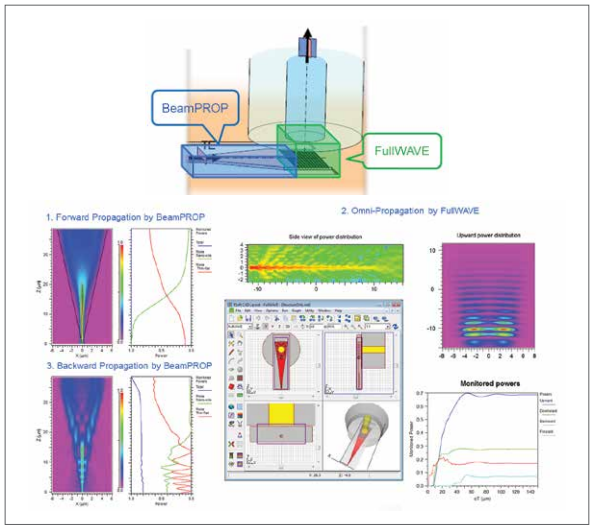

Figure 3: Vertical coupler for fiber to waveguide coupling modeled in BeamPROP and FullWAVE. BeamPROP is used to analyze the spot size converter, and FullWAVE is used to analyze the grating coupler