Development of Optical Simulation Software for Ultra-Stable Optical Bench Fabrication

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Why do we need a 3-D interferometer simulation software?

Motivations:
- Analyze satellite altitude jitter-OPL coupling error;
- Analyze thermal-OPL coupling error;
- Analyze vibration effects;
- Calculate components' alignment requirements;
- Get geometrical parameters of Optical Interferometer.

Characteristics:
- "OPTICAL SIMULATION" is developed based on MATLAB platform;
- Building 3D Interferometer model;
- Auto-configuration of components;
- Static and dynamic simulation.

Theorem of Optical Simulation

Optical Simulation Software

Data types (16 data structures) Functions Sets (96 Functions)

Plate Component Cube Component Spherical Component Spherical Component Lense Cube Component Gaussian Beam Beam Finding Functions Geometrical Functions Optical Functions System Alignment Functions Dynamic Simulation Functions Other Functions

Optical Simulation Software

Beam Axis Tracing Arithmetic & Beam Calculation

Finding effective intersection point

True

False

Building Step Node

Building Reflection and Refraction Node

Add to Beam Tree

Step 0 Step 1 Step 2 Step 3 Step 4

TEM00 Gaussian Beam Interference Calculation

Parameters:
- Fused Silica Components;
- Spherical Lens;
- Focal length: 60 & 10 mm;
- Input laser beam waist 2.5 mm.

Optical Path Calculation

Differential Wave-front Sensing Simulation

Optical Interferometer Design

Positioning Ball Coordinates Calculation

Static Simulation

- Calculate the beat signal output by PD or QPD;
- Using PhaseMeter function to get the signal phase.