

# Modern Optical Testing

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## Day 1, Morning:

Introductory remarks

Basic interferometry and optical testing

- Two Beam Interference
- Fizeau Interferometer
- Twyman-Green Interferometer
- Laser Based Fizeau
- Mach-Zehnder Interferometer
- Typical Interferograms
- Interferograms and Moiré Patterns
- Classical techniques for inputting data into computer

Direct phase measurement interferometry and optical testing

- Phase-Stepping and Phase-Shifting (Integrated Bucket)
  - Basic concept
  - Phase shifters
  - Algorithms
  - Phase-unwrapping
  - Phase shifter calibration
  - Error due to phase shifter and detector nonlinearities, stray reflections, and quantization

## Day 1, Afternoon

Direct phase measurement interferometry (continued from above)

- Spatial Synchronous and Fourier Methods
- Solving vibration problems
- Multiple Wavelength and Vertical Scanning (Coherence Probe) Techniques

Measurement of surface quality

- Lyot Test
- FECO
- Nomarski interferometer
- Phase-shifting interference microscope

## **Day 2, Morning**

Testing flat surface optical components

- Mirrors
- Windows
- Prisms
- Corner cubes
- Diffraction gratings

Measurement of index inhomogeneity

Testing curved surfaces and lenses

- Test Plate
- Twyman-Green Interferometer (LUPI)
- Fizeau (Laser source)
- Shack Cube Interferometer
- Scatterplate Interferometer
- Smartt Point Diffraction Interferometer
- Sommargren Diffraction Interferometer
- Measurement of Cylindrical Surfaces
- Star Test
- Shack-Hartmann Test

Testing of aspherical surfaces

- Description of aspheric surfaces
- Null Test
  - Conventional null optics
  - Holographic null optics
  - Computer generated holograms
- Non-Null Test
  - Lateral Shear Interferometry
  - Radial Shear Interferometry
  - High-density detector arrays
  - Sub-Nyquist Interferometry
  - Long-Wavelength Interferometry
  - Two-Wavelength Holography
  - Two-Wavelength Interferometry
  - Moiré Interferometry

## **Day 2, Afternoon**

Testing of aspherical surfaces (continued from above)

Absolute Measurements

- Flat Surfaces
- Spherical Surfaces
- Surface Roughness

State-of-the-art of direct phase measurement interferometers

# Motivation for Course

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- **If you make optics you have to be able to test the optics because you cannot make optics any better than you can test.**
- **If you purchase optics you need to test the optics you buy to make sure the optics meet the specs.**
- **If you let the supplier know you are going to test the optics when you receive them you will get better optics.**

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