Modern Optical Testing

James C. Wyant
College of Optical Sciences
University of Arizona
jcwyan@optics.arizona.edu
www.optics.arizona.edu
www.optics.arizona.edu/jcwyan
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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
  o Conventional null optics
  o Holographic null optics
  o Computer generated holograms
- Non-Null Test
  o Lateral Shear Interferometry
  o Radial Shear Interferometry
  o High-density detector arrays
  o Sub-Nyquist Interferometry
  o Long-Wavelength Interferometry
  o Two-Wavelength Holography
  o Two-Wavelength Interferometry
  o 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

• 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.
References

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  Modern Optical Engineering

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SPIE
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