IN244 AUG 2:1

Optical Metrology

Instructor

Dr. Sai Siva Gorthi
Email: saisiva@iisc.ac.in

Teaching Assistant

Email:

Department: Instrumentation and Applied Physics

Course Time: Tue., Thu., 10:00 - 11:00 AM; Fri., 3:00-4:00 PM

Lecture venue:

Detailed Course Page:

Announcements

Brief description of the course

This course is offered to Masters and PhD students (those who might have taken some basic level course on Photonics/Optics before) to introduce them to various modern "Optical Metrological Tools": the process of Setting-up an Experimental tool to encode the information about the measurand in one of the parameters of light (Amplitude, Phase, Frequency, etc.), acquiring the images/signals (with a camera or a photo-diode) and subsequent image analysis algorithms (decoding techniques) to retrieve the information are taught as essential parts of Optical Instrumentation Techniques.

Prerequisites

All assignments and exercises (experiential part) would warrant implementing the codes in MATLAB to analyze the images. Thus, familiarity with MATLAB is a prerequisite.

Syllabus

Dimensional Metrology: Pinhole Camera Model, Camera Calibration,

Laser Triangulation, Structured Illumination Techniques, Fringe Analysis,

Phase Unwrapping, System Calibration Techniques.

Various Interferometric Techniques such as Michelson,

Mach-Zehnder, Fabry-PÃ©rot, Holographic, Speckle, MoirÃ©, VISAR and Common Path Interferometry.

Metrology with Optical Microscopy: Basics of Microscopy, 2-D and

3-D measurements, Optical Sectioning, Super-resolution, Surface Profiling and Quantitative Phase Imaging.

This course also provides hands-on experience for important representative experimental techniques such as Michelson Interferometry, 4-f System, Digital Holography, Stereo Vision, Fringe Projection Profilometry, and Quantitative Imaging (Microscopy).

Course outcomes

Basics of Optical Instrumentation, Computational Imaging, and Image Analysis/ Demodulation Techniques. Gains hands on experience in setting up the optical systems and making measurements with them. Experience with processing the digital images acquired in optical metrology tools to decode the information about the measurand on MATLAB platform.

Grading policy

25% for Assignments, 25% for Experiments, 50% for Final Exam

Assignments

Six Assignments are given during the course, all of which contain both theoretical and experimental parts that covers the topics such as Michelson Interferometry, 4-f System, Digital Holography, Stereo Vision, Laser Triangulation, Fringe Projection Profilometry, and Quantitative Imaging (Microscopy).

Resources

References:

1) "Optical Metrology" by Kjell J.Gasvik
2) "Introduction to Fourier Optics" by Joseph W.Goodman
3) "Fundamentals of Photonics" by B.E.A. Saleh and M.C.Teich
4) "Quantitative Phase Imaging of Cells and Tissues" by Gabriel Popescue