Optical Metrology

Instructor
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Teaching Assistant

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
Various Interferometric Techniques such as Michelson, Mach-Zehnder, Fabry-Perot, Holographic, Speckle, Moiré, 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