

WORCESTER POLYTECHNIC INSTITUTE

MECHANICAL ENGINEERING DEPARTMENT

HOMEWORK – CHAPTER 07

COURSE No.: ME-593N, Fall 2000
COURSE NAME: Laser Metrology and Nondestructive Testing (NDT)
<http://www.wpi.edu/~cfurlong/ME-593N>
DATE: 25 October 2000
DUE: 01 November 2000

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NOTE: In all solutions, state explicitly every assumption and/or approximation made, explain every procedure, and justify its use. Dimensional analyses are absolutely necessary. All results must be expressed in appropriate units. PLEASE, ALWAYS SHOW ALL WORK, while writing your results only on one side of the sheet(s) of paper; start each problem on a new sheet. *Attach this sheet to your solution. Show your work using a clear and professional style.*

PROBLEM 7.1. Refer to homework for Chapter 06. The two 16-bit RTI images from previous homework correspond to the *sine* and *cosine* data images obtained from a digital speckle phase correlation experiment used to characterize shape of a spherical component by applying the two-wavelength optical contouring technique. Use both of the 16-bit data images and evaluate their corresponding *wrapped phase*. Generate a 32-bit RTI image and a displayable 8-bit image (i.e. PGM binary or text, TIFF, BMP) containing wrapped phase information.

You can find hints and information about RTI images on the website for this course. Along with your results, please provide hard and soft copies of your software (as well as any compilation and linking instructions).

PROBLEM 7.2. Write a computer program capable of reading, writing, and displaying RTI images. Your program should run under the MS Windows environment and must be capable of reading, writing, and displaying any 16 or 32-bit RTI images.

Utilize a high level programming language to develop your application (Visual Basic or C++ are recommended). Along with your results, please provide hard and soft copies of your software (as well as any compilation and linking instructions).

READING 7.1. Chapter 7 (handout) from: C. Furlong, *Hybrid, experimental and computational, approach for the efficient study and optimization of mechanical and electro-mechanical components*, Center for Holographic Studies and Laser micro-mechaTronics, Worcester Polytechnic Institute, Mechanical Engineering Department, Worcester, MA, 1999.

READING 7.2. H. A. Vrooman and A. M. Maas, "Image processing algorithms for the analysis of phase-shifted speckle interference patterns," *Applied Optics*, **30**(13) 1636-1641, 1991.
