MECHENGINEERING SEMINAR

Mechanical characterization by optical solid mechanics experimental techniques

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Abstract

Numerous optical techniques in experimental solid mechanics provide capabilities for full-field deformation measurements on materials and structures under mechanical loading. Two of such techniques are used to characterize the mechanical behavior of various materials, including polymers, bio-tissues, foams, and granular materials. In projection Moiré technique, or a variant of it, fringe projection, gratings are projected onto a surface, and the projected grating pattern is superimposed with a reference grating to form virtual Moiré fringe pattern. Unwrapping the phase angle in the fringes gives surface topography, which is analyzed in connection with the applied loads to determine the mechanical response. This technique is applied for biaxial testing of materials at different scales, including bio-tissues. Another optical technique that is receiving increased attention is digital image correlation, in which a material point, with a distinct surface grayscale pattern surrounding it, is tracked by computer vision to determine the deformation with sub-pixel resolutions. A variant of the technique as applied to volumetric images, i.e., digital volume correlation is used to determine internal deformations of materials including plastic foams, granular materials, and particulate composites to identify deviatoric deformation and damage evolutions in materials.

Biography

Dr. Hongbing Lu is a Professor, Associate Department Head and Louis Beecherl Jr., Chair of Mechanical Engineering in the Erik Jonsson School of Engineering and Computer Science at the University of Texas at Dallas. He received his Ph.D. in Aeronautics at Caltech in 1997, M.S. degree in Engineering Mechanics at Tsinghua University in 1988, and B.S. degree in Solid Mechanics at Huazhong University of Science and Technology in 1986. He has over 100 journal publications in experimental mechanics and mechanics of time-dependent materials. His work has been funded by NSF, AFOSR, NASA, ONR, Army, NIH, and industry. He is a Technical Editor of Experimental Mechanics, and Mechanics of Time-Dependent Materials. He received the NSF Career award in 2000. He is a corresponding member of the International (Russian) Academy of Engineering, ASME fellow, SEM fellow, and AIAA Associate Fellow.