Guest Editorial

Photomechanics I

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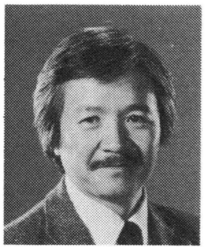
Many readers of *Optical Engineering* may find the word *photomechanics* confusing. It is a term coined by Dr. A. J. Durelli almost 30 years ago (indeed he has a book with this title: *Introduction to Photomechanics,* by A. J. Durelli and W. F. Riley, Prentice-Hall Inc., 1965) to describe a discipline wherein the practitioners use optical methods such as photoelasticity to perform stress analysis of structures under load. Since then, the meaning of photomechanics has broadened to include the study of all mechanics problems (e.g., deformation of solids and flow of fluids) using optical techniques.

Some six years ago I organized two special issues of *Optical Engineering* devoted to this topic (May/June and July/August 1982 issues on Coherent and Incoherent Optical Techniques in Experimental Mechanics). During the intervening years, the state of the art has advanced substantially, and the number of practitioners in the field has increased. The latter is evidenced by the fact that more than 130 papers were presented at and several hundred people attended last year's SPIE International Conference on Photomechanics and Speckle Metrology in San Diego. The two present special issues* on photomechanics are largely a result of this conference. I have selected a representative sample of papers, after review and revision, to appear in these two issues. The selection process is obviously biased toward my perspective of the field. Nevertheless, I hope I can bring a good overview of this fascinating subfield of optical engineering to the readers of this journal.

One of the most important developments in photomechanics, I believe, is the application of speckle methods to fluid flows. In 1982 it was just budding. Now it is an important subfield of experimental fluid mechanics called speckle (or particle image) velocimetry. To reflect this, I have selected three papers to appear in this first issue. Another important development is the combination of holographic interferometry and laser speckle photography in a way that was not realized before. Li and Chiang have coined the term *holospeckle interferometry* to describe this marriage, and their paper provides a unified analysis of these two seemingly unrelated techniques. A novel approach to the speckle method is presented by Han and Tu, from which one can foresee its application in nonlaboratory environments. A new application of the so-called white light speckle method to the measurement of interior strain displacement is given by Chiang and Lu. In the past few years substantial improvements have been made in both the laser speckle strain gauge technique and the method of moire interferometry, as described by Yamaguchi and Pirodda, respectively. Three-dimensional photoelasticity remains one of the most important tools in photomechanics, and the paper by Srinath et al. gives a description of its current development. Finally, the paper by Chiang et al. offers a new approach to the old method of geometrical moire for strain measurement, making its sensitivity comparable to the resistance strain gauge.

*The Photomechanics II special issue will appear in the August 1988 issue of this journal.



F. P. Chiang obtained his Ph.D. in mechanics and engineering science from the University of Florida in 1966. He joined the State University of New York at Stony Brook in 1967 and is currently the director of the Laboratory for Experimental Mechanics Research and a leading professor of mechanical engineering. In 1973–74 he was a visiting professor at the Swiss Federal Institute of Technology in Lausanne and in 1980–81 was a senior visiting fellow at the Cavendish Laboratory of the University of Cambridge. His major research interest is in the theory and application of optical methods to mechanics and metrology. He has worked in the areas of photoelasticity, moire, holography, and laser and white light methods.