# Track 4:
# Engineering Applications of Residual Stress

*Organized by:* Gary S. Schajer, University of British Columbia; Gavin Horn, University of Illinois at Urbana-Champaign

## *Sponsored by the SEM Residual Stress Technical Division*

The Residual Stress Technical Division is proud to sponsor a new track this year "Engineering Applications of Residual Stress." The creation of this new track reflects the practical importance of residual stresses in engineering systems and design. The hidden character of residual stresses often causes them to be underrated or overlooked. However, they profoundly influence structural design and substantially affect strength, fatigue life and dimensional stability. Since residual stresses are induced during almost all materials processing procedures, for example, welding/joining, casting, thermal conditioning and forming, they must be taken seriously and included in practical applications.

This track highlights the wide range of research relating to residual stresses, including stress development, control, modeling, measurement, and physical responses of engineering components. These topics are organized into five major sessions scheduled on Wednesday and Thursday:

- Destructive (Relaxation) Residual Stress Measurements
- Non-Destructive Residual Stress Measurements
- Residual Stress and Reliability on the Micro- and Nano-scale
- Industrial Residual Stress Measurements
- Modeling and Experimental Validation of Residual Stresses

The Residual Stress Technical Division sincerely thanks all the speakers for carefully preparing their presentations, and looks forward to an informative and stimulating SEM Annual Conference 2011. Welcome!

## Keynote Presentation:

**Armando Albertazzi Jr.**
Universidade Federal de Santa Catarina

Wednesday, June 15 • 9:00 AM • Session 53

### *Residual Stresses Measurement and Inner Geometry Inspection of Pipelines by Optical Methods*

This paper describes three different optical systems used outside the lab for pipeline inspections. The first one is a robust and portable ESPI based hole-drilling unit with radial sensitivity used for residual stresses measurement. The device uses a special diffractive optical element that produces an achromatic interferometer. The displacement component around the hole drilled is measured by ESPI with radial in-plane sensitivity and is fitted by last square methods to evaluate residual stresses. Some calibration and performance evaluation data are presented, as well an infield application for analyzing the integrity of a gas pipeline. The second system is a conical laser triangulation based device to measure the geometry of the inner surface of pipes. A laser beam is deflected by the nose of a conical mirror and produces a radial light plane that intercepts the inner surface of the pipe producing a bright line all way around 360°. The image of the light line is used to compute the radius of about 1400 points in each section while the device is moved along the pipe axis. Finally, the third one uses active photogrametry to measure in cylindrical coordinates the details of the inner geometry of pipe junctions and welding seams.

**Armando Albertazzi G. Jr** is a professor at the Mechanical Engineering Department of the Federal University of Santa Catarina, Florianópolis, Brazil, since 1987. He is the head of the Metrology Laboratory and leader of the optical metrology group. His major research interest is optical metrology applied for 3D shape, stresses and residual stresses measurement. He was the leader of about 20 research projects in this field. He was the advisor of 33 masters and 14 PhD students, all in the field of optical metrology. He is author or coauthor of about 150 research papers and one text book on metrology. He was nominated Fellow of the International Society for Optics and Photonics in 2008.