Preface

Residual Stress, Thermomechanics & Infrared Imaging, Hybrid Techniques and Inverse Problems, Volume 8: Proceedings of the 2013 Annual Conference on Experimental and Applied Mechanics represents one of eight volumes of technical papers presented at the SEM 2013 Annual Conference & Exposition on Experimental and Applied Mechanics organized by the Society for Experimental Mechanics and held in Lombard, IL, June 3–5, 2013. The complete Proceedings also includes volumes on: *Dynamic Behavior of Materials; Challenges in Mechanics of Time-Dependent Materials and Processes in Conventional and Multifunctional Materials; Advancement of Optical Methods in Experimental Mechanics; Mechanics of Biological Systems and Materials; MEMS and Nanotechnology; Experimental Mechanics of Composite, Hybrid, and Multifunctional Materials; Fracture and Fatigue*.

Each collection presents early findings from experimental and computational investigations on an important area within Experimental Mechanics, Residual Stress, Thermomechanics & Infrared Imaging, Hybrid Techniques and Inverse Problems being three of these areas.

Residual stresses have a great deal of importance 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.

In recent years, the application of infrared imaging techniques to the mechanics of materials and structures has grown considerably. The expansion is marked by the increased spatial and temporal resolution of the infrared detectors, faster processing times, and much greater temperature resolution. The improved sensitivity and more reliable temperature calibrations of the devices have meant that more accurate data can be obtained than were previously available.

Advances in inverse identification have been coupled with optical methods that provide surface deformation measurements and volumetric measurements of materials. In particular, inverse methodology was developed to more fully use the dense spatial data provided by optical methods to identify mechanical constitutive parameters of materials. Since its beginnings during the 1980s, creativity in inverse methods has led to applications in a wide range of materials, with many different constitutive relationships, across material heterogeneous interfaces. Complex test fixtures have been implemented to produce the necessary strain fields for identification. Force reconstruction has been developed for high strain rate testing. As developments in optical methods improve for both very large and very small length scales, applications of inverse identification expand to include geological and atomistic events.

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