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## *Residual Stress Measurements that Correlate Fatigue and Fracture Behavior*

In recent years, advancements in residual stress measurements have improved our ability to quantify the effects of residual stresses on structural performance. Residual stresses are locked into structural materials during manufacture or processing of components, and are known to significantly affect performance. Typically, they affect subcritical cracking due to fluctuating stress (fatigue) and environmental exposure (environmentally assisted cracking) and may increase or decrease the time required for cracks to nucleate and then the rate of crack growth; less typically and more dramatically, residual stresses affect capability to sustain single applications of service loading. Historically, except in special cases, available methods have not allowed measurements of the spatial variation of residual stresses that could enable reliable forecasts of component performance. Over the past few decades, a handful of residual stress measurement methods have been put into practice with demonstrated capability of enabling reliable performance forecasts. This paper provides a summary of two of these residual stress measurement methods and describes their application to correlate the behavior of residual stress bearing coupons.

**Prof. Michael R. Hill** has devoted his professional career to residual stress engineering, which combines methods for residual stress processing, residual stress measurement, and fatigue and fracture assessment. His published works are in the areas of residual stress measurement, modeling, and failure prediction. Prof. Hill has worked extensively on the development of the laser shock peening surface treatment process, in collaboration with Lawrence Livermore National Laboratory and LLNL's industrial partner Metal Improvement Company. In the context of that work, Hill developed a framework for residual stress engineering to facilitate the deployment of deep residual stress treatments for improved component lifetime and damage tolerance. He founded an industrial services firm, Hill Engineering, LLC, to address the needs of commercial clients in tackling complex structural problems with a special emphasis on residual stress engineering.

Prof. Hill completed his Ph.D. in Mechanical Engineering at Stanford University in 1996 (advised by Drew V. Nelson and Sheri Sheppard), having earned his B.S. and M.S. degrees in Mechanical Engineering at the University of Arizona in 1989 and 1991, respectively (advised by Paul H. Wirsching).