

Abstract

When measuring residual stresses using the hole-drilling strain-gauge method, plasticity effects arise if the residual stress level exceeds about 6% of the material yield strength. In this case the classical methods, which are based on the linear elastic material behavior, do not work properly and residual stresses are overestimated. This paper presents a numerical study of the influence of plasticity on residual stress measurement by using the hole drilling strain-gauge method in those cases in which stress does not vary with depth. The study investigates the effects of the most important loading, measuring, geometry and material variables. An iterative method was implemented in ANSYS using the APDL macrolanguage (ANSYS Parametric Design Language Guide, Documentation for ANSYS 11.0) to automatically execute the procedure steps. A finite element model of the hole, which allows for plasticity, is requested. Employing the readings of standard three elements strain-gauge rosette, the method makes it possible to extend the measurement limit in comparison to that of the ASTM E837 standard & ASTM E837-08, "Standard Test Method for Determining residual Stresses by the Hole-Drilling Strain-Gauge Method").