Mapping Multiple Residual Stress Components Using the Contour Method and Superposition

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The standard contour method determines the residual stress component normal to the plane of measurement. This talk presents extensions to the contour method to allow determination of multiple stress components. Two extensions are presented, both using additional stress measurements and then superposition to determine the original residual stresses. The first extension involves making additional cuts to determine stresses on multiple cut planes, using only the contour method. The second extension involves measuring in-plane stresses on the surface exposed by the original cut, using x-ray diffraction and hole drilling in this case. Experiments were preformed on indented disks of both 316L stainless steel and 2024-T351 aluminum. Results are compared with a finite element prediction and with stresses independently measured using neutron diffraction to show that the new theories are valid. Additional issues discussed will include the necessity to include a calibrated cyclic hardening model in the finite element simulation, difficulties in measuring surface stresses, and the repeatability of contour measurements on identical specimens.