Aerospace
Conventional Power Generation
Manufacturing
Maritime
Nuclear Power Generation
Oil and Gas
Rail and Transport

VEQTER

Residual Stress Experts

VEQTER is an engineering company providing excellence in the measurement, analysis and management of residual stresses. We are world leaders in our field and offer expertise on any aspect related to residual stresses in engineering components and structures.

Contour Technique

The contour technique is a destructive mechanical strain release (MSR) technique that provides a full uniaxial map of the residual stresses normal to a two dimensional cut plane through the specimen.

The technique, based on a variation of Bueckner's elastic principle of superposition, involves carefully cutting a specimen into two pieces with wire-EDM and measuring the resulting cut surface deformations due to residual stress redistribution. It is well suited to spatially varying residual stress fields, with measurement size limited only by the size of the cutting machinery – VEQTER can perform measurements up to a width of around 500mm. The measured contour surface is examined in detail with a 0.1µm resolution surface probe, and then the deformations are used to reconstruct the residual stress field in a finite element model.

To find out how VEQTER can help you please contact us on +44 (0) 117 992 7970 or using experts@veqter.co.uk

VEQTER Ltd. **8 Unicorn Business Park, Whitby Road, Bristol BS4 4EX, UK**
e experts@veqter.co.uk t +44 (0) 117 992 7970 w www.veqter.co.uk

VEQTER

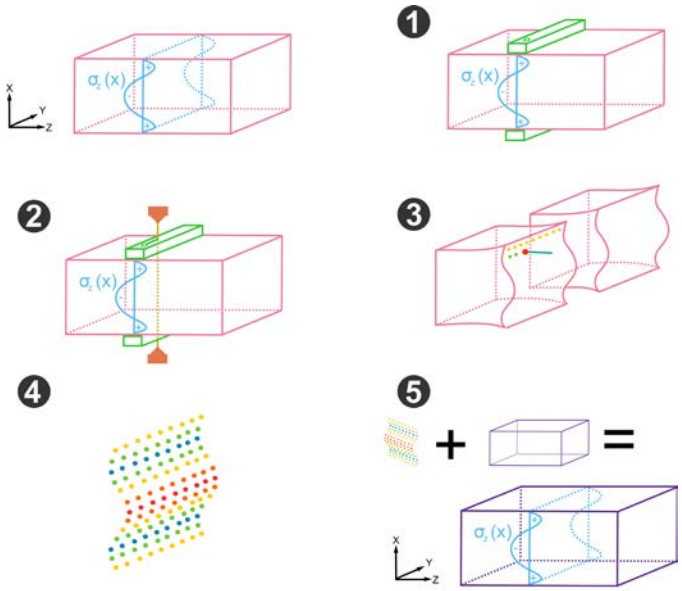
Residual Stress Experts

Contour Technique Procedure:

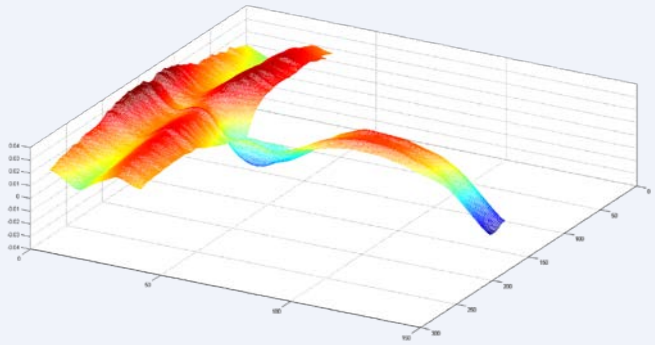
The procedure for the contour technique can be divided into 5 basic stages:

1. The specimen is mounted using bespoke fixtures and a pilot hole is drilled to constrain the component and limit EDM cut opening.
2. A fine 250 - 500µm brass EDM wire is used to slowly cut the specimen in a single pass using low energy settings.
3. The contours of the cut surfaces are measured with a coordinate measuring machine (CMM), recording the out-of-plane deformations resulting from the relaxation of the out-of-plane residual stresses.
4. The CMM surface data are combined, averaged and smoothed into one single 2D contour surface of deformations.

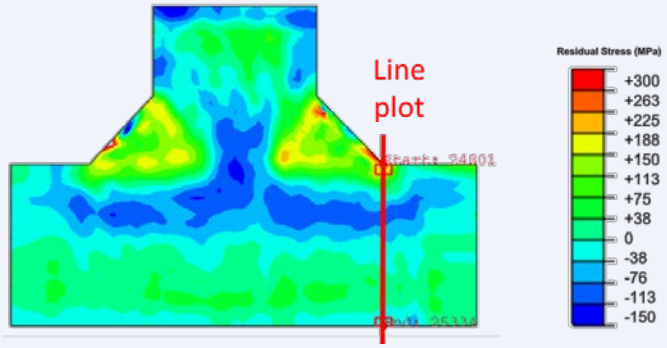
   The single 2D contour surface is inverted and introduced into a 3D finite element (FE) model as a boundary condition to reconstruct the original residual stress state of the specimen in the direction normal to the cut surface.



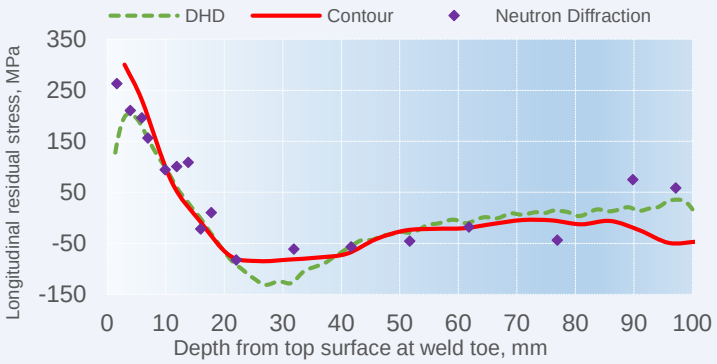
An illustration of the principal used to calculate residual stresses from the cut surface deformations.



Surface deformations measured from a T-section contour cut



Residual Stress contour plot of a T-section contour cut



Contour, DHD and Neutron Diffraction weld toe comparison graph

Technique Specifications:

- Measurement section is limited by the wire EDM axis ranges (500mmx500mmx500mm);
- Laboratory based measurements;;
- A full field 2D uniaxial stress map is produced;
- Nominal accuracy: 10MPa – Aluminium, 30MPa – Steel, 15MPa – Titanium;
- A robust process utilising on “off the shelf” hardware and software;
- Price competitive with respect to the amount of residual stress data produced;
- Destructive;
- Indifferent to grain structure/texture of component material;
- “Clean” EDM surface allows further research, including etching, XRD measurements and more contour.