DETAILED PROFILING OF RESIUAL STRESS IN A COLD EXPANDED HOLE

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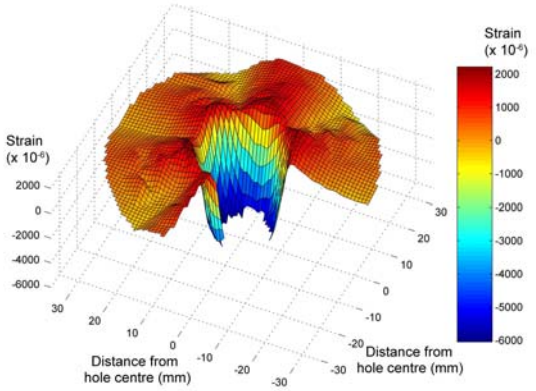
The technique of split-sleeve cold hole expansion is now adopted in many industries world-wide. The process effectively draws an oversized mandrel through a hole in order to plastically deform the bore of a hole. It was developed to impart a beneficial compressive residual stress state around the bore and thus to improve fatigue performance and lifetime. Various techniques are available to investigate the post-expanded stress state although diffraction techniques using highly penetrating radiation are particularly applicable (X-rays, neutrons).

A number of studies have shown the well accepted profile of near-bore compressive hoop stress balanced by a low tensile component away from the hole. Most of these studies have used relatively coarse measurement steps and have simply considered the 1D profile of stress at mid-length of the hole (mid-thickness).



This paper presents a series of measurements of 3D residual strain and stress around split-sleeve cold expanded holes. Measurements were made using high energy synchrotron X-rays at the European Synchrotron Radiation facility (ESRF). Two expanded hole specimens were studied of bore diameters 6mm and 12mm both with nominal 4% expansion. The variation of residual stress is shown both in-plane and through-thickness. The influence of the raised ‘pip’ in the bore resulting from the split-sleeve is presented.