WAVELET ANALYSIS OF X-RAY DIFFRACTION SIGNAL FROM MEASUREMENTS OF STRESS AND AUSTENITE

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Real materials are subjected to deformations, which can be adequately described by a strain tensor. However, the common practice in the engineering world is to assess the materials in terms of stress. Therefore, the calculated stress, used in characterizing the structural stability of the material, must be deduced from the strain tensor, using appropriately constructed constitutive equations. There are several methods to measure the strain tensor, but the most important non-destructive one is X-ray Diffraction method (XRD). It is based on quantum mechanical assumptions, but its major analytical features can be cast in the form of mathematical transformations. If a constitutive equation, relating the strain and stress tensors, determined experimentally from crystallographic measurements, is provided, the state of stress can be calculated from the constitutive equation. Therefore, it is important to measure the strain tensor as accurately as possible. To carry out the task, the X-ray signal must be analyzed very accurately, and some of the strain components must be calculated through a level of arising ellipticity of the recorded signal. Since the signal is non-parametric and probabilistic, Wavelet Analysis (WA) is a good mathematical tool to carry it out. In the paper to be submitted, the WA approach is presented as a very good alternative to analyze the X-ray signal. It will be demonstrated how the analysis is carried out to minimize the error. It will be shown how the engineering world can benefit from the novel method of stress measurement in a variety of applied and residual stress states as well as in retained austenite determination.