Estimation of microscale strain fields in a pearlitic steel using DIC and in-situ SEM

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In this contribution the Digital Image Correlation (DIC) technique is used to identify strain fields within a pearlitic microstructure from in-situ obtained SEM images. Typically this is done using a synthetic speckle[1] but in this study the intensity field variations, related to the microstructure of pearlite, are used as a natural speckle.

As a means to avoid subsets with inadequate information content (in terms of intensity field variations) a tracebility criterion is introduced. This criterion is based on the eigenvalues of the Hessian of the autocorrelation function. A pertaining algorithm, which can be used to identify high quality subsets (in terms of tracebility) within a certain Region Of Interest (ROI), is also presented. Examples of identified high quality subsets within an ROI are shown in Fig. 1. By using the obtained irregular subsets grids together with synthetically deformed images the displacement and deformation gradient errors (both local and average) are studied as a function of the applied loading for various subset sizes.

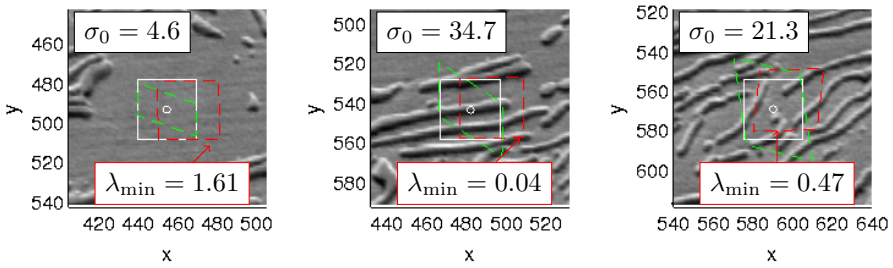

Figure 1: Subsets with varying information quality. Left: insufficient intensity variations, mid: anisotropic information content, right: high quality subset.

[1]Sutton et al., Metrology in a scanning electron microscope: theoretical developments and experimental validation, *Measurement Science and Technology*, **17**, 2613, (2006)