Reconstruction of Residual Deformation Field from Moiré Patterns in the X-ray Interferometry

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The aim of this work is a search of approaches for the solution of inverse problem – reconstruction of the spatial distribution of the residual strain field from the features of change of moiré fringe periods, shape and intensity. Based on the method of numerical calculation of moiré patterns, developed in [1], for different model representations as series of local concentrated sources of residual strains, arising after scribing, the influence of size and distribution features of strains on change of shape and periods of moiré fringes was studied (Fig.1c-g).

The comparison of calculated and experimental moiré patterns (Fig.1a,b) [1,2] allows us to assert about the presence of maximum deformations at the edges of scratches, which corresponds to more intensive indenter indentation at the beginning of scribing (Fig.1c,d). Introduction of structural moiré allows to characterize the contribution of each source deformation to the total field is not only near but far from scratch.

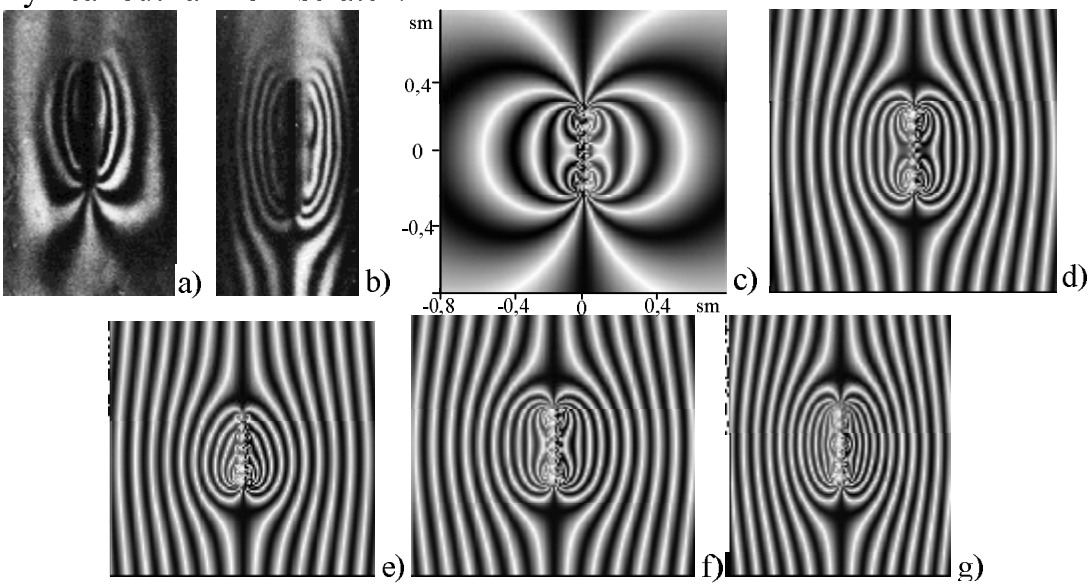

Fig. 1. Experimental moiré images [1] of scratch placed perpendicular to the diffraction vector (220), Cu$K_{\alpha 1}$ radiation (a,b). Calculated moiré images in dependence on the character of force displacement in a rows: without structured moiré Λ=0 (c), and with structured moiré Λ=1200 μm. Force distribution: parabolic (c,d), exponential (e), uniform in central part and rapidly increasing at the ends (f), chaotic (g).

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