FACH HOCHSCHULE LÜBECK
University of Applied Sciences

“Inhomogeneity of radiographic anti-scatter grids”

Master’s Thesis - Biomedical Engineering

PHILIPS

Abstract

Anti-scatter grids are longstanding components in radiographic X-ray imaging applied to enhance image quality by reducing the effect of scattered radiation. The structural homogeneity of the grid, which is determined either by the manufacturing process or the design, is strongly connected with the perceived homogeneity in the image expressed by dominant residual stripe pattern, the so called mottle.

This thesis investigates the feasibility to detect inhomogeneous grids with common X-ray equipment. One method is proposed which measures stripe inhomogeneity of images for different frequency ranges based on digital image processing. In order to evaluate the test method probable measurement uncertainties are analyzed and quantified by performing diverse experiments.

The proposed method yield promising results and experiments show that stripe inhomogeneity can be quantified and characterized by its size. It is feasible to examine the behavior of the grid for several scenarios. Beyond, images of grids based on different designs are processed with the algorithm and the obtained results can be confirmed by experts.

However, the experiments also reveal that the measured inhomogeneity is massively influenced by acquisition parameters and that slight changes in the alignment or using different equipment lead to large measurement fluctuations. To generate reproducible and reliable results with the proposed method the acquisition parameters must be accurately defined and the test equipment must be properly calibrated.

Further investigations show an influence of the grid frequency on the measurement results. The reason is the combination of detector MTF, the arrangement of the harmonic repetitions in the spectral domain and the position of the transition bands of the applied frequency decomposition. This means, that grids of different frequency cannot be matched to one general specification value. One method is introduced which provides the comparability of different grid types by producing a shift of the frequency components in the spectrum. Evaluations reveal that the shift can be realized accurately by increasing the distance between grid and detector.

Author: Johannes Köpnick