

# Preface by the Series Editor

The book *Three-Dimensional Digital Tomosynthesis: Iterative Reconstruction, Artifact Reduction and Alternative Acquisition Geometry* by Dr. Yulia M. Levakhina is the 14th volume of the Springer-Vieweg series of excellent theses in medical engineering. The thesis of Dr. Levakhina has been selected by an editorial board of highly recognized scientists working in that field.

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# Foreword

Conventional X-ray imaging suffers from the drawback that it only produces two-dimensional projections of a three-dimensional object. This results in a reduction in spatial information (although an experienced radiologist might be able to compensate for this). In any case, a projection represents an averaging. The result of the averaging can be imagined if one were to overlay several radiographic sections at the light box for diagnosis. It would be difficult for even an expert to interpret the results, as averaging comes along with a considerable reduction in contrast, compared with the contrast present in one slice.

In the 1920s, the desire to undo the averaging process that characterizes conventional X-ray radiography led to the first tomographic concept. The word tomography was considerably influenced by the Berlin physician Grossmann, whose Grossmann tomograph was able to image one single slice of the body. The principle of the conventional or analog geometric tomography method is very simple. During image acquisition, the X-ray tube is linearly moved in one direction, while the X-ray film is synchronously moved in the opposite direction. For this reason, only points in the plane of the rotation center are imaged sharply. All points above and below this region are blurred, more so at greater distances from the center of rotation. However, blurred information above and below the center of rotation does not disappear, but is superimposed on the sharp image as a kind of gray veil or haze. Therefore, a substantial reduction in contrast is noticeable.

This book on *Three-Dimensional Digital Tomosynthesis: Iterative Reconstruction, Artifact Reduction and Alternative Acquisition Geometry* summarizes the research work of Dr. Yulia Levakhina. The work has been carried out at the Institute of Medical Engineering at the University of Lübeck. It focuses on image-improvement methods for a tomosynthesis device working with insufficient and inconsistent projection data.

If the raw projection data to be used for 3D reconstruction in X-ray imaging are insufficient and/or inconsistent, artifacts cover the reconstructed objects that reduce the diagnostic value of the images significantly. However, digital tomosynthesis is a concept that is based on the reconstruction of three-dimensional volumes from a few projections.

This book concludes the results of a number of original papers and innovations Dr. Yulia Levakhina has achieved in the discipline of digital tomosynthesis. A new method for the reduction of out-of-focus artifacts and an innovative acquisition geometry are spotlights that significantly exceed the current state-of-the-art.

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