Summary

This doctoral thesis, entitled *Analytical statistical approach to the problem of image reconstruction from projections applied to multifocal spiral computer tomographs*, deals with the image reconstruction from projections problem. The presented in this thesis approach is adopted to the CT devices with the FFS technique, i. e. the construction of variable focal computed tomographs. The second problem faced by this work is the implementation of a statistical reconstructive algorithm based on a continuous-continuous data model. That is due to the fact that during each CT scan, the patient absorbs a hudge dose of ionizing radiation, which is harmful to living organisms. This problem became a challenge in the development of the computed tomography technique. Unfortunately, reducing the dose causes problems with the deteriorating reconstructive image in quality. The use of a statistical algorithm is to help to reduce this negative impact. In this PhD thesis, two approaches to signal processing are proposed, which significantly help solve the above mentioned problems. The first of these approaches is based on the direct use of projections obtained in a spiral tomograph, similarly to the Feldkamp algorithm. The second one uses the so-called algorithms with a "nutating" reconstruction plane, conceptually similar to the ASSR (Advanced Single Slice Reconstruction) method.

It is also challenging to obtain the images reconstructed by the tomograph as quickly as possible. In the reference solution, the time for the acquisition of the first images is counted within the range of 10-90 minutes, depending on the number of sections to be reconstructed. That makes it impossible for such a system to operate, for example, in an outpatient setting. The solution proposed in this paper allows for significant reduction of this time, using appropriate hardware (GPU, multi-core processors) and programming techniques. Thanks to this, the first cross-sections are obtained in seconds (less than 10s).