ITERATIVE RECONSTRUCTION ALGORITHMS FOR THE REDUCTION OF ARTIFACTS IN HIGH RESOLUTION X-RAY COMPUTED TOMOGRAPHY

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ABSTRACT

BACKGROUND

X-ray Computed Tomography (CT) allows for the possibility to visualize the internal structure of complex objects in a non-destructive way. For the quantification of the obtained data it is important to start from a reconstructed data set with high image quality and few artifacts.

METHOD

Reconstruction algorithms based on filtered backprojection are still most commonly used for the reconstruction of CT data. Alternatively, iterative reconstruction methods can be used. These algorithms are known to result in longer reconstruction times, but this can be compensated by using an efficient implementation on a graphical processing unit (GPU).

RESULTS

Iterative reconstruction algorithms have shown promising results for the reduction of noise and artifacts such as metal and cone beam artifacts and for the improvement of image quality when only a limited number of projections or a limited angular range is available. Another advantage of iterative reconstructions algorithms is that physical effects, such as beam hardening, can be incorporated in the forward projector of the algorithm. In this way the beam hardening is taken into account during the reconstruction rather than using pre- or post processing techniques. Additionally, this method has the advantage that no prior knowledge about the sample or the beam spectrum is required, while most available methods for beam hardening correction require at least some prior knowledge, which is often not available in the case of experimental high resolution CT.

CONCLUSIONS

Iterative reconstruction algorithms are a useful alternative to the more commonly used filtered back projections algorithms in high resolution CT. These algorithms can reduce artifacts and can be modified to include physical effects such as beam hardening.

Index Terms— X-ray computed tomography; Tomographic reconstruction; Modeling of image formation