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Foreword

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The field of X-ray imaging has been expanding rapidly since Röntgen's historical discovery in 1895. X-ray computed tomography (CT), as the first non-invasive tomographic method, has revolutionized imaging technologies in general. Although it has been well established, X-ray CT still promises exciting new directions for research and development, as evidenced by this special issue consisting of 7 original papers of high quality.

The importance of spiral cone-beam CT for medical imaging was highlighted in a special issue of IEEE Trans. Med Imaging in 2000 [1]. Katsevich's inversion formula published in 2002 [2] represents a significant breakthrough in this area. In this special issue, the first paper, Yang et al proposed an algorithmic structure of Katsevich's formula, which does not explicitly involve PI segments. This work is useful to select scanning parameters, and reduce the computational complexity. In the next paper, Zhu et al. formulated X-ray and 3D Radon transforms for ellipsoids and tetrahedral. Their results provide a benchmark for comparison of cone-beam algorithms.

Iterative algorithms outperform analytic counterparts when data are noisy and incomplete, but they are much slower and often impractical. With the recent improvement of computing techniques, iterative reconstruction can be accelerated via parallel processing [1]. The paper by Benson and Gregor reported how to program iterative algorithms for cone-beam micro-CT on PCs. Several issues were addressed, including the number of cluster nodes, inter-processor communication, design of ordered-subsets, partition of projection and image data.

Micro-CT becomes more and more popular for animal studies of normal and diseased states and processes. This type of *in vivo* imaging applications has required a better understanding and minimum delivery of the radiation dose. The paper by Obenaus and Smith discussed the dose reduction, which highlights how to avoid significant/lethal doses.

A state of the art micro-CT scanner takes about 20 seconds to acquire a complete dataset, which is too slow to capture the rapidly beating heart of a small animal. In the paper by Ge Wang et al. the first electron-beam micro-CT (EBMCT) prototype was designed for cardiac imaging of the mice and

rats. The proposed system targets 0.03–0.01 s temporal resolution, 0.2 mm spatial resolution, and 10% contrast resolution.

In high-energy transmission industry computed tomography, convolution back-projection is widely used for image reconstruction. But high mass thickness and the requirement of short scanning time lead to high statistical noise. In the paper by Zhao et al. a novel statistical model, genetic discrete Markov random filed (GDMRF), was developed. The discrete gray set and genetic character of gray set as two characteristics of the model were addressed. They also performed extensive experiments and comparisons with other iterative algorithms.

We hope that this special issue would attract a major attention of the peers. We would like to express our appreciation to all the authors, reviewers, and the Editor-in-Chief Dr. Hong Liu for the tremendous efforts that have made the timely completion of our assignment successful and pleasant.

References

[1] G. Wang, C.R. Crawford and W.A. Kalender, Multirow detector and cone-beam spiral/helical CT, *IEEE Trans Med Imaging* **19** (2000), 817–821.

[2] A. Katsevich, Theoretically exact filtered backprojection-type inversion algorithm for Spiral CT, *SIAM Journal on Appl Math* **62** (2002), 2012–2026.