Algebraic Reconstruction of X-ray Tomography on Parallel Computing Architecture of LSDF

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Abstract

The world fastest tomography is being built up at the ANKA Synchrotron Light Source (Institute for Photon Science and Synchrotron Radiation, KIT) for studying static and moving biological objects in 3D and high temporal and spatial resolutions. The resulting mounts of data are challenging for the reconstruction process in terms of reconstruction algorithm and hardware infrastructure. To enhance the reconstruction of a volume using only a few hundred projections, an algebraic reconstruction technique based on a more precise forward transform model and compressive sampling theory is used. As it is commonly known as a computing expensive method, an automatic workflow is built up to connect the the Large Scale Data Facility (LSDF) to the tomography beamline of ANKA to enhance the data storage and analysis efficiency. The connected computing resources at the LSDF process the 3D reconstruction by distributing the whole job into multiple parallel computing tasks. Promising reconstruction image quality and high computing performance are reported. This study contributes to the construction of the world fastest tomography system at ANKA and will enhance the X-ray tomography application in fields of chemistry, physics, biology and in the study of the properties of new materials.