A FAST RECONSTRUCTION ALGORITHM FOR TRUNCATED TOMOGRAPHY DATA

Xianghui Xiao*[1], Ronald F. Agyei[2], Michael D. Sangid[3]

[1]Advanced Photon Source, Argonne National Laboratory, USA
[2]School of Aeronautics and Astronautics, Purdue University, USA

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Summary: We proposed here a fast filtered-back-projection type algorithm that is capable to process tomographic data taken in limited view angles. This method has been applied to real experimental data successfully.

* email: xhxiao@aps.anl.gov

1. ABSTRACT

Tomography measurements usually require taking projection images of a sample in angle ranges of 180 or 360 degrees. This allows tomographic reconstructions from the complete information in the corresponding reciprocal space. In synchrotron tomography applications, it is often necessary to have cases in which the images are only taken in limited views, especially to accommodate in situ sample environment control constraints. The missing data in tomography data can cause severe artifacts. We invented an algorithm based on interpolation to compensate for the missing data. The processed data can then be reconstructed with filtered-back-projection (FBP) type algorithms. This method is fast and efficient compared to iterative algorithms. This talk focuses on the use of this method in the reconstruction of real experimental data obtained from in situ tomography measurements of glass fiber enforced polypropylene polymer composite materials under monotonic loading. The two supporting posts in the load frame blocks an angle of 22.4 degree in the projection views. Figure 1a shows the sinogram of one slice. The middle of the sinogram is corrupted due to the missing data. By discarding the data in the missing range, FBP gives slice reconstruction shown in Fig. 1b, thus resulting in strong artifacts that overwhelm most real structural features. With our interpolation method, the missing data is compensated for and this ameliorates the effect of the artifacts, as can be seen in the slice reconstruction shown in Figure 1c and Figure 1d (a zoom-in view of the boxed region in Fig. 1c). The result shows clearly the effectiveness of this interpolation method.

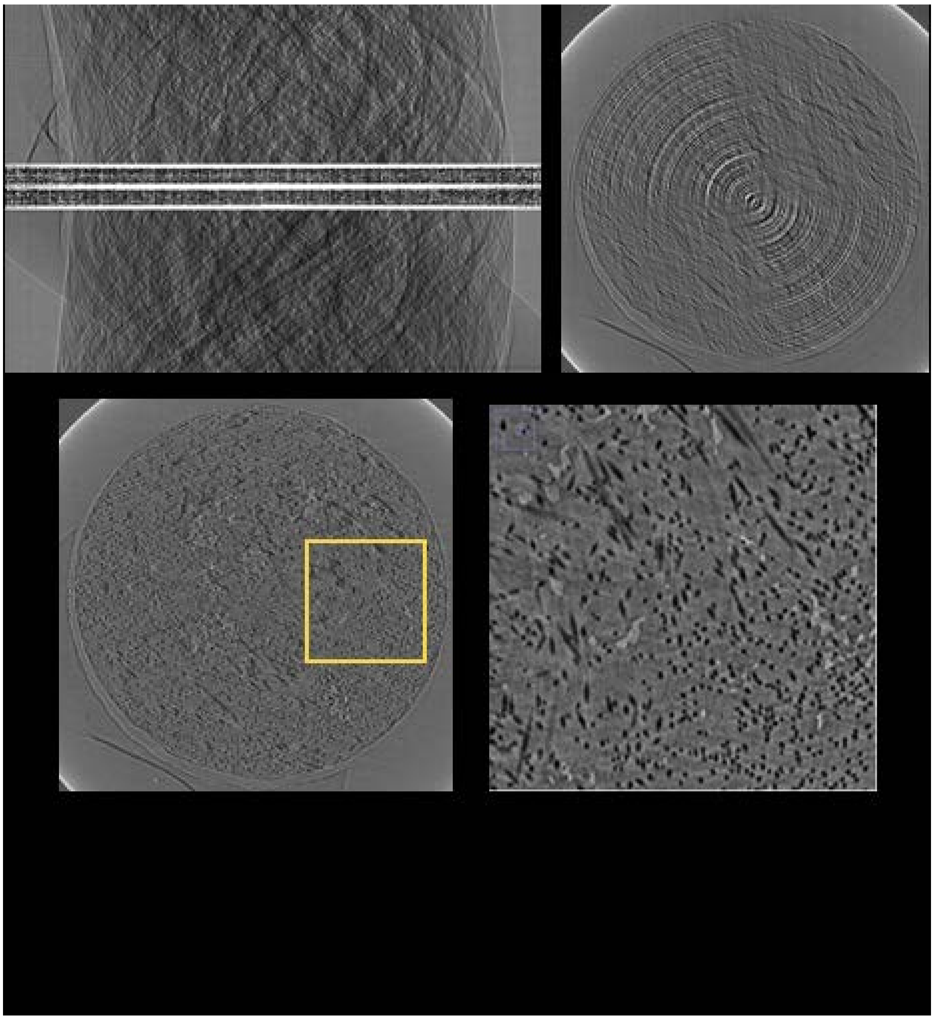

Figure 1. Tomography measurement of a glass fiber enforced polymer composite sample under monotonic loading with a load frame supported by two posts. (a) Sinogram of a slice; the middle region is corrupted due to the missing data; (b) FBP reconstruction of the slice with the missing data being discarded in the reconstruction; (c) FBP reconstruction of the slice with the interpolation method. (d) shows the zoom-in view of boxed region in (c).