Robotized X-ray inspection of large industrial parts: non-standard trajectories and 3D reconstruction

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Classical X-ray inspection of large parts is generally performed in fixed configurations, either on field or inside dedicated facilities, with both radiography testing (RT) and X-ray Computed Tomography (XCT). With the development of robotic arms, X-ray inspection can benefit from the flexibility they can offer in terms of positioning. During the last decade, the use of robotic arms rapidly increased in all inspection areas and nowadays their use is quite common for a large number of industrial applications. In this article we present our work on modeling, scan optimization and in particular on CT reconstruction approaches adapted for a setup with the source and detector positioned on two robotic arms. For our typical applications with this setup, we employ extended field radiography, laminography and XCT on non-standard or adapted trajectories. Due to the limitations in the accessible range around the samples, advanced reconstruction algorithms must be used. In the past, we proposed analytical reconstruction algorithms for incomplete helical trajectories. We also worked on iterative algorithms including regularization techniques and the use of CAD model as a priori information. Recent work is linked to the optimization of the scan dataset through a selection of the best views for a given sample. We present our approaches on synthetic data and recent experimental results acquired on the robotized X-ray inspection cell as part of a facility in our department.