Improvement of radiographic images quality using algorithms dedicated to geometric blur reduction

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X-ray and gamma-ray images are degraded under the combined effect of detector response, scattered radiation, the size of source and other various parameters. Geometric unsharpness in particular not only reduces the sharpness of image edges but also could reduce the overall contrast, making defect detection difficult or impossible. Most of the time, geometric unsharpness is chosen to preserve a sufficient image quality when possible, but sometimes, due to geometric, physical or industrial constraints, geometric unsharpness is imposed and the image quality is insufficient. This choice is always a compromise between a sharp and well contrasted image and a reasonable exposure time to keep a low noise level. Nevertheless, we could consider things differently if we have restoration algorithms allowing to remove blur due to geometric effects. Indeed, source detector distance should not be a constraint anymore and then we could imagine an important benefit on time exposure or noise reduction. In this paper, we lead a simulation study to evaluate a numerical method allowing to remove or at least reduce geometric unsharpness and thus to improve image quality in constrained conditions. The first challenge is to estimate the geometric Point Spread Function (PSF) due to source size. The difficulty comes from the fact that the PSF depends on each point of the testing object. We thus developed a model to evaluate two dimensional PSF for a given experimental setup and for any points of space. Knowing the PSF's along a given direction source-pixel, we are able to apply non-blind deconvolution algorithms on ROI images around this direction. The study shows that even with a huge blurring, restoration is possible with different algorithms using our geometric PSF. Finally, we investigate the possibility to use criteria to evaluate blur in the restored images in the aim to know the best PSF and then estimate localisation of the defect within the thickness of the wall.