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X-RAYS TOMOGRAPHIC RECONSTRUCTION IMAGES OF MATERIALS USING INVERSE PROBLEM RESOLUTION BASED ON SPARSE REGULARIZATION METHOD

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ABSTRACT

X-rays computed tomographic images are reconstructed from a large number of measurements of x-rays transmission through the materials (called projection data). The resulting images are tomographic "maps"of the x-rays linear attenuation coefficient. Images reconstruction using a small number of projections allows the advantage of reducing the time of data acquisition. One such advantage is its interest in several fields, such as medical applications and non-destructive evaluation of material in industry. Mathematically, a low number of projection falls within the framework of ill-posed problems. Image reconstruction using classical algorithms are not suitable for this class of problem, which makes the reconstruction unstable and the resolution is achieved by imposing a priori information.To overcome this problem, recent research suggests that regularization methods introduce constraints on the required solution.

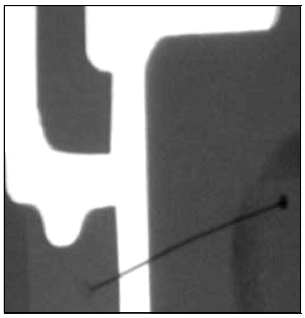
Keywords: X-ray tomography, image reconstruction, sparse regularization method.

RESULTS AND CONCLUSIONS

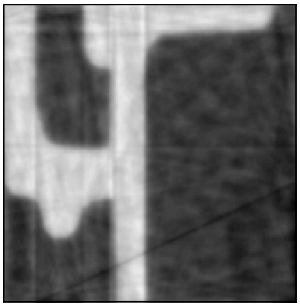
In this paper, a sparse regularization method in an orthogonal basis is studied and applied to X-rays tomographic reconstruction 2D images. This method is based on total variation algorithm associated to L^1 norm. The inverse problem can therefore be regularized by using primal dual formulation based on proximal functions. We applied this method to non-destructive evaluation of material in the case of 2D reconstruction of X-rays tomographic images containing real defects. The obtained results in this work were compared with those obtained by classical methods. This comparative study has shown a significant improvement proved by: (i)-Reduction of computation time, (ii)-Enhancing image quality, (iii)-Reducing of projections number.

	Constant step by step descent algorithm	C. step by step descent algorithm +Total Variation	Modified 1st order primal dual algorithm
Image wtihout noise			
Image with noise			

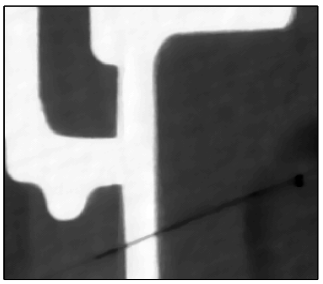
Fig. 1 - Synthetic images



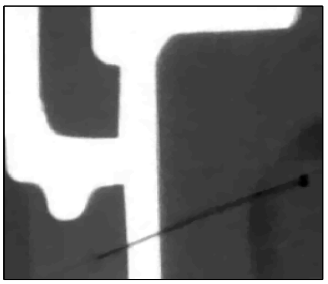
Real input Image



Reconstructed image using constant step by step descent algorithm. PSNR= 28.38



Reconstructed image using constant step by step descent algorithm +Total Variation. PSNR=38,65



Reconstructed image using modified 1st order primal dual algorithm. PSNR=43.32

Fig. 2 - Real images

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