

New Imaging Approaches in Ultrasonic Non Destructive Testing

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The total focusing method (TFM) is becoming a standard in the nondestructive testing industry. TFM generally provides lower noise and higher lateral resolution than conventional phased array imaging. Furthermore, TFM opens doors to the development of a new generation of advanced imaging methods. In the study presented in these two papers, we compare several advanced imaging methods. First, we present Delay-and-sum (DAS) approaches where the purpose is to build each pixel by summing the contributions of each Ascan at the proper time of flight. The output image is therefore focused at every pixel. These methods generally give better image quality than conventional phased-array imaging. Next, we examine migration methods, which work within the wavenumber domain and are known to give better image quality than DAS approaches. We also present results from TFMp, a method based on an inverse problem approach. In this method, the purpose is to consider a specific structure of the piece under test, contrary to the previous approaches. We assume a sparse structure, meaning that the piece under test contains point-like reflectors. The image is obtained by minimizing a data misfit criterion including a sparse penalization term. Metrics such as lateral resolution and peak signal to noise ratio (PSNR), which defines the contrast, are used to adequately compare the methods. Migration methods give a better PSNR than DAS methods and provide similar lateral resolution. The TFMp approach can be combined with any method except migration and gives outstanding results for lateral resolution and PSNR compared to standard methods.