Improving ultrasonic medical image quality by attenuation of the secondary lobes

A Rician Based Beamformer

Oscar Martínez-Graullera, Virginia Yagüe-Jiménez, Montserrat Parrilla Romero, Alberto Ibáñez Rodríguez.

Instituto de Tecnologías Físicas y de la Información (ITEFI). Spanish National Research Council (CSIC)

oscar.martinez@csic.es

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Abstract

In ultrasound imaging, the delay-and-sum beamforming (DAS) constitutes a solid measure of the acoustic reflectivity of the scene. If it is applied to synthetic images following the Total Focus Method (TFM), it can generate an image with high resolution and contrast. The present work analyses the data set that composes an image point from a statistical point of view and proposes a new beamforming technique capable of improving the image contrast.

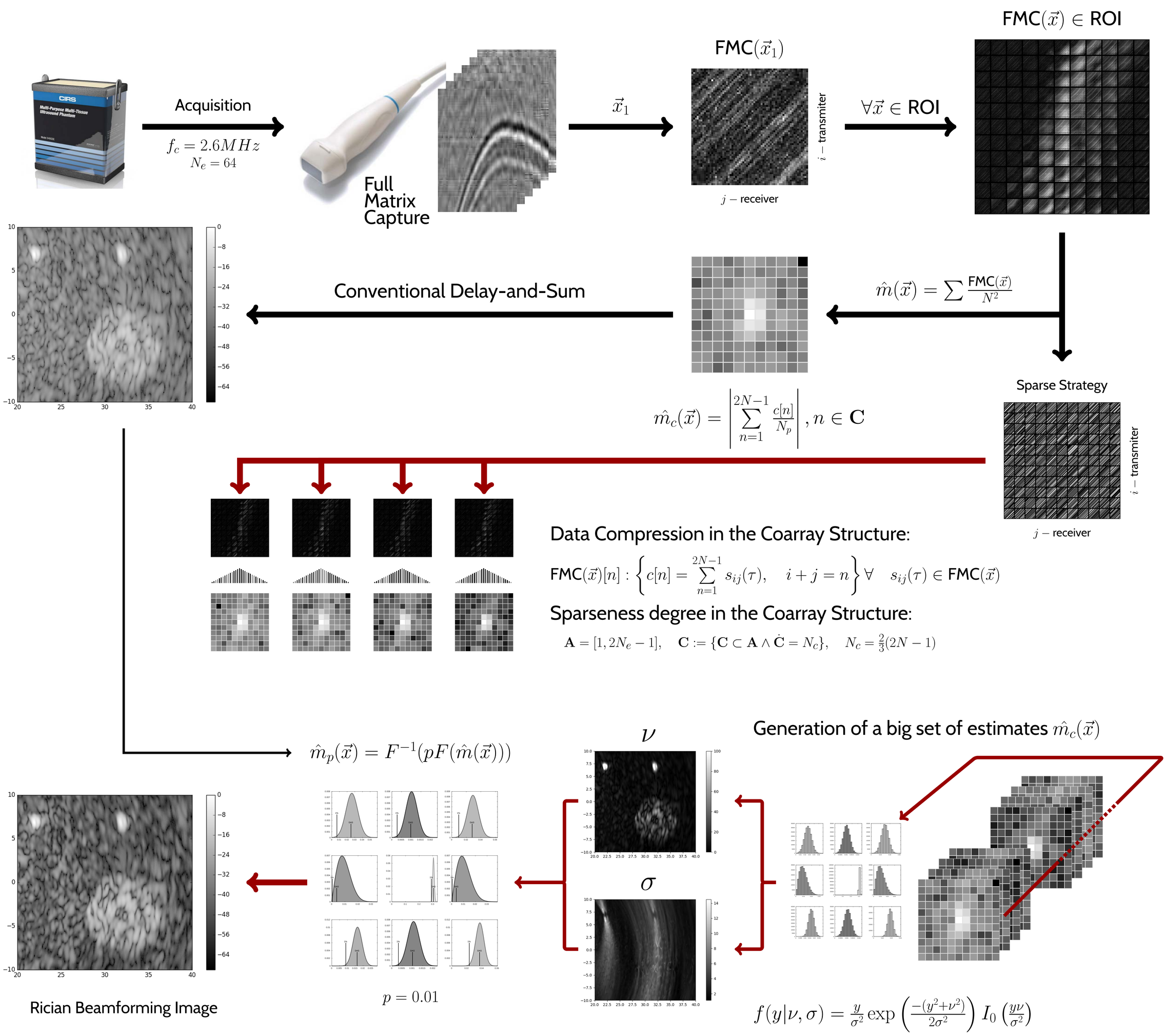
Introduction

For a point in the Region Of Interest (ROI), the DAS-TFM is implemented as the sum of the Full Matrix Capture (FMC) signal samples that accomplish the focusing law. This operation exploits spatial diversity of the array to provide a robust measure of the scene reflectivity. However, acoustic noise produced by secondary lobes is determined by the acquisition system and the elements in the ROI that are invariant between acquisitions. So, there is a lack of diversity that makes it difficult to apply conventional strategies. **The solution addressed in this paper is to induce the diversity by applying changes in the acquisition system**. As far as we are concerned, this scenario can be generated via virtual sparse coarrays.

Let's define the set FMC$(\vec{x})$ as the collection of samples that are used to compute the reflectivity at the point $\vec{x}$ of the ROI obtained with a linear array of N elements.

$$\text{FMC}(\vec{x}) : \left\{ s_{ij}(\tau), \tau = \left|\frac{\vec{x}-\vec{x}_i}{c}\right| + \left|\frac{\vec{x}-\vec{x}_j}{c}\right| \forall i,j = [1,N] \right\}$$

Statistical Beamforming Process



Conclusions

The results show that the Rician beamformer is able to increase the contrast in the image. Future works will be addressed to improve the analysis of the distribution in regions where reflectors and sidelobes are present and improve computational cost.

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