

ACOUSTICS2008/1486**Separation of single and multiple scattering: Application to the ultrasonic detection of a target embedded in a diffusive medium**

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We present a new imaging technique dedicated to the detection of a target embedded in a strongly scattering medium. Classical imaging techniques such as echography fail in this kind of configuration because of multiply scattered echoes and aberration distortions. The experimental set up consists in an array of programmable transducers placed in front of a collection of steel rods randomly distributed. The slab thickness is three times the mean free path. Behind this strongly diffusive slab, we set an echogene steel cylinder that we want to detect and localize. The impulse responses between each couple of transducers are measured and form the interelement matrix. Our technique separates the single-scattered echoes from the multiple scattering background. This is possible because of a deterministic coherence of single-scattering signals along the antidiagonals of the array response matrix, whatever the distribution of scatterers. Once this operation is performed, the detection of the target is achieved by applying the DORT method (French acronym for decomposition of the time reversal operator). The quality of detection is assessed theoretically with Random Matrix Theory and shown to be, by far, better than what is obtained with echography and the classical DORT method.