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# Extraction of the multiple scattering contribution in weakly scattering media: Application to human soft tissues

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Waves scattered by a weakly scattering random medium contain a predominant single scattering contribution as well as a multiple scattering contribution which is usually neglected. But its investigation can be fruitful for characterization purposes because it provides measurements of statistical parameters such as the scattering mean free path. Our aim is to extract the multiple scattering contribution in a weakly scattering random medium. The experimental set up consists in an array of programmable transducers placed in front of the sample. The impulse responses between each couple of transducers are measured and form the interelement matrix. Our technique allows the extraction of multiple scattering signals by taking advantage of their randomness, contrary to single scattering contributions which are shown to exhibit a deterministic coherence along the antidiagonals of the array response matrix, whatever the distribution of scatterers. To illustrate the interest of this technique, we applied it to a synthetic medium (Agar gel) and to breast tissues. Surprisingly, the multiple scattering contribution is far from negligible in the breast around 4.3 MHz. The temporal evolution of its intensity can provide a new tool to complete information provided by standard echography; it also constitutes an experimental test of the Born approximation.