Time Reversal in Ultrasound Medical Applications

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Abstract

In this paper, we review some of the main applications investigated during the past decade. An iterative implementation of the time-reversal process allows tracking gallstones in real time during lithotripsy treatments. In this application domain, a smart exploitation of the reverberations in solid waveguides permits the focusing of high amplitude ultrasonic shock waves with a small number of transducers. Finally, because time reversal is able to correct the strong distortions induced by the skull bone on ultrasonic propagation, this adaptive focusing technique is very promising for ultrasonic hyperthermia brain therapy and even high resolution brain echography. An overview of the applications of time reversal in the field of biomedical imaging will be presented. Finally, it will be shown how it is possible by using ultrafast frame rates in ultrasonic imaging to image the viscoelastic properties of soft tissues for cancer diagnosis.