Deconvolution of the Spatio-temporal Effects of Membrane Hydrophones in Pulsed Ultrasonic Fields Measurements: A simulation Study.

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Abstract : In order to carry out reliable measurements of pulsed ultrasonic fields, the use of a piezoelectric hydrophone as receiver is recommended. However, due the finite size of the receiver aperture the measured acoustic pressure is affected by spatial averaging. The output signal may also be distorted because of the frequency variations of its transfer function. The aim of this work is to deconvolve the spatio-temporal effects of the receiving chain (hydrophone, cable, oscilloscope...) in order to reconstruct the pulsed ultrasonic field with higher spatial and temporal resolution using numerical simulations. This constitutes an inverse problem, which has been encountered in various domains of physics and technique. The possibility of deconvolving the spatial effects has been shown for harmonic ultrasonic fields. The present contribution is a generalization of the study to pulsed ultrasonic fields. The results of this study show the strong dependency of the reconstruction quality upon the signal- to-noise ratio (SNR), the hydrophone dimensions and the axial distance to the source.

Keywords : pulsed ultrasonic fields, finite size, deconvolve the spatio-temporal