EXPERIMENTAL OBSERVATION OF NONLINEAR SELF-FOCUSING IN THE CAVITATION FIELD

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ABSTRACT

The nonlinear self-focusing of the pressure field with onset of cavitation is experimentally and theoretically analysed in the kHz range. Self-focusing in the cavitation field has already been reported above 500 kHz and it was attributed to the non-uniformity of bubble density [1]. In this case, bubble density remains small, non-linearity is weak and focal distance remains much larger than the acoustic wavelength in the liquid.
In this work, inertial cavitation field radiated by a 20 kHz sonotrode-type transducer is considered. A cone like bubble structure is established. This structure is very repetitive and self-constructs in any container when a piston like emitter is used [2]. The acoustic field is directly evaluated by using a BR&K. hydrophone and averaged pressure waveforms are analysed. The number of chosen samples is high enough to have stable measured pressure results (including nonlinear distortion). A self-focusing effect is observed with a focal distance comparable to the acoustic wavelength in the liquid. Models accounting for the high bubble density and strong non-linear effects are proposed. Theoretical predictions are compared to experiments and discussed.