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Study on the shock-bubbles interaction in the two bubbles case

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The interaction of a shock wave with a spherical bubble, and the consequent formation of a vortex ring, has been studied thoroughly. It was shown that the vortex ring posses a constant velocity which can be scaled according to the initial parameters of the problem.

In the present study, theoretical and experimental research was performed on the interaction of two bubbles arranged in series, after the passage of a shock wave. The main goal was to investigate the limiting distance separating the interaction into two cases: the first of a significant interaction between the two bubbles, or resultant vortex rings, and the second of no mutual effect, i.e. the dynamics of one bubble is totally independent of the other. This distance was mapped in the parameter space of bubble size ratio and the distance of the centers of the bubbles. This was done by conducting full numerical simulations, together with suitable experiments performed in a shock tube.

The results show that the existence of one bubble is evident on the evolution of the other in two possible mechanisms. One is the alteration of the incident shock wave by the first bubble. The encounter of a curved shock wave on the second bubble will alter its evolution into a vortex ring. The second mechanism is the influence of the spiral velocity field surrounding the first vortex ring on the second bubble. It was seen that the effect of a curved shock wave has a closer range since the shock wave tends to retain its planar form in a short time. The interaction of the first vortex ring with the second bubble is more gradual and the effect can only be seen at latter time than that of the curved shock wave. An example for the limiting ranges in the case of a two bubbles of the same initial size, is that the curved shock wave mechanism is relevant up to an initial distance of 2.5 diameters (the bubble diameter was taken as 2cm) and that there is no interaction when the initial distance is 4 diameters.