Acoustic streaming in liquids

Acoustic streaming denotes the flow induced by a propagating acoustic wave in liquid. On the one hand, acoustic streaming offers a contactless way of stirring either corrosive or particularly delicate fluids such as liquid silicon in the semiconductors manufacturing process. On the other hand, recent works show that it can unwillingly spoil velocities measurements obtained with ultrasounds, a crucial technique when dealing with liquid metals and opaque fluids for instance.
It is investigated with both experimental and numerical approaches. A 2MHz circular plane transducer, used as an acoustic source, is introduced inside a water tank. The measurements concern the acoustic pressure field (hydrophone) and the velocity field (PIV). Numerical simulations are also performed with the software STARCCM+^{TM}. They solve the incompressible Navier Stokes equations with an acoustic force source term. A good agreement is obtained between the experimental and numerical results through several configurations.

Experimental study of gas entrainment through surface swirl

In Sodium cooled fast nuclear reactors, the presence of eddies at the free surface combined with the downward flow created by the suction of hot liquid sodium (by the intermediate heat exchanger) can provoke entrainment of gas (argon). Such entrainment induces safety issue since gas could be transported to the bottom of the vessel and may lead to the accumulation of gas pockets close to the core of the reactor.
The study focuses on gas entrainment from surface swirls through an experimental apparatus in water. A shear flow is generated between a horizontal flow and a stagnant flow, and a vertical pumping is added, at the bottom of the test section, to produce gas entrainment. The objectives are: first, to identify the experimental condition of gas entrainment occurrence, second, to describe and quantify the occurrence of gas entrainment (shadowgraphy, image processing) and third, to characterize the physical mechanisms involved (PIV). These experiments support the validation of TRIO_CFD, a CEA internal code.