PARTICLE POSITIONING BY AN ULTRASOUND FIELD EXCITED BY STRUCTURAL VIBRATIONS

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The controlled positioning of small particles is still a challenge in micro technology. Earlier approaches use acoustic forces to manipulate single or few particles in a fluid. These forces act on particles in a sound field. However existing systems are often very complicated or only work in special environments.

We developed a method to position and move particles in a fluid by acoustic forces. These forces arise in an ultrasound field that is excited by structural vibrations of a solid. A vibrating plate emits the sound that is reflected at the plane surface of another body. Between these two bodies a two- or three-dimensional standing sound field is build up, depending on the vibration of the plate. With this sound field it is possible to position small particles in one or two dimensions and to hold them in an equilibrium position in the third dimension. By changing the sound field the particles can be moved.

In experiments we use polystyrene spheres of a diameter between 10 microns and 100 microns as particles. With a quasi one-dimensional vibration of the plate a two-dimensional sound field is established and the particles are concentrated in lines. The particles can be in contact with the mentioned surface or they can levitate in the fluid.

The technical setup is presented and the excitation of the vibrations is explained. A theoretical calculation of the force field that acts on the particles will be introduced. In addition several methods to use this technique to concentrate particles at predetermined positions, to let them levitate freely in the fluid and to move them are shown. Experimental results are presented and compared with the theoretical model.