

Summer Research Program 2011/2012

Ultrasonic Contactless Gripper

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Objective

The objective of this project is to create a way of gripping particles in air without direct contact by using ultrasonic fields established by high frequency vibration.

Description

At the microscale it is possible to grab particles using microgrippers, a much more difficult process is to release them again due to sticking forces far exceeding the particle's weight at these scales.

A solution to this is to hold the particle without touching it. This on the surface seems farfetched, but force fields can be excited which do not require solid body contact, such as by using ultrasound. By establishing an ultrasonic resonant field, forces can be created which align particles suspended in a fluid, this can be seen in the figures. However for the application of a gripper, operation must be in air. There is some evidence for using such acoustic radiation forces in air, but there has been very little research, and none at the microscale. The task of this project will be to examine some ways of exciting resonant pressure fields in air, to form the basis of making contactless grippers.

The project will involve finite element modelling coupled with experimental testing of micromachined components.

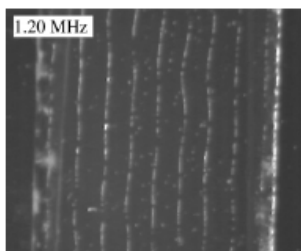


Fig. 1: 12µm particles collected into lines in a microfluidic channel oscillating at 1.20 MHz

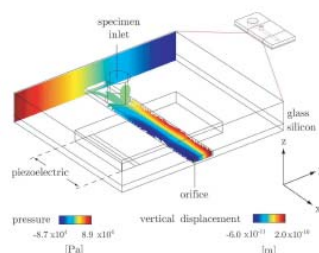


Fig. 2: Finite element modelling results predicting the formation of a line of particles along a water filled channel

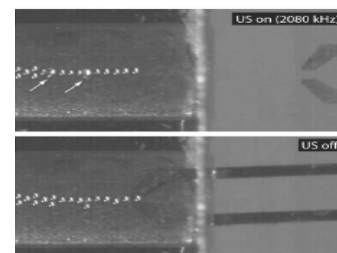


Fig. 3: Particles being removed from the resulting line by a microgripper. The gripper is performing the easier task of gripping, releasing proves to be much more problematic