Motivation

Acoustic separation is a relatively new method for the recovery of valuable particulate matter from suspensions and/or purification of liquid streams [1,2]. This technique of acoustic separation is mainly applied in biotechnology and medical technology [3,4]. Our aim is to apply this technique on separation of valuable suspensions in small to medium scale industrial water applications.

Concept

By creating ultrasonic standing waves in a suspension flow in a reactor, particles are forced to move to specific grid points in the reactor (Figure 1). Although in a standing wave the forces are small, this effect on particles is strong enough to manipulate particles for separation purposes. In addition to particle properties, such as radius, density and elastic modulus, this force also depends on excitation frequency, pressure amplitude and properties of ambient medium. Depending on the particle properties it is possible to move particles to a different position (Figure 2). Larger particles experience larger effects in terms of acoustic radiation force and drag resistance. They move to the target locations much faster than smaller particles (Figure 3). In addition to standing waves, travelling waves can be used, too (Figure 1).

Research goals

- Investigate the sound field under different excitation conditions such as standing and travelling waves
- Understand the particle behavior under a given sound field
- Exploit the behavior of particles to develop selective separation strategies
- Design a separator that can separate particles based on given criterion
- Explore the energy efficiency of the separator and possible improvements for industrial applications