

## Automation algorithms for microfluidic operations

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Category: In-house

### Project description

Microfluidics is a relatively new technology emerged in the past two decades. This technology focuses on the technical approaches handling fluidics samples and phenomena in the micro-meter ( $10^{-6}$  m) scale. The foreseeable significant applications of microfluidics opened doors in a wide range of biomedical applications (e.g. bio-sample analysis and drug delivery). Fluidigm Co., Advanced Microlabs LLC and Advanced Liquid Logic Inc. are examples of recently established international microfluidics-based companies. Clearly, microfluidics has been creating tremendous potentials in the future market worldwide.

Here we have planned to apply a software package to automate and optimize the microfluidic operations (e.g. liquid delivery and mixing). While the hardware instrumentation will be provided by the supervisor, the selected student will need to develop a user interface program including also a function set to control particular microfluidic processes: (1) liquid delivery into a microchamber, and (2) liquid mixing in a closed microchamber. The integrative knowledge of various engineering aspects (i.e. solids, fluids, heat transfer, controls and image processing) involved in this project can upgrade the student's insights to general engineering problems.

### Preliminary sub-tasks

*The followings are very brief tasks breaking down the overall objective into multiple achievable sub-goals. They are yet unconfirmed, but are listed to provide an idea of what the works are about.*

- Image acquisition for the microfluidic components using a microscopic camera.
- Feature extraction of the acquired images using image processing techniques.
- Correlate the dynamics of the image features with the device performance.
- Design and implement operation strategies to control the microfluidic operations.

### Technical contents

*These are the components that the students are expected to acquire (mainly provided by the supervisor), therefore only minimal or no prerequisite knowledge of the candidate is required.*

- Basic solid mechanics, fluid mechanics, and heat transfer.
- Interface programming using C++ (for the communication between a computer and its external devices)
- Graphic user interface developed using Visual C++
- Image analysis and processing techniques

**Students are highly recommended to contact the supervisor for details in advance.**