Master thesis

Reliability of Transposer-Based Microfluidic Routing Fabric in The Case of Multiple Edge Failures

Single-cell analysis is used to gain insights into diseases such as cancer. Recently, a hybrid microfluidic platform was proposed for concurrent single-cell analysis on thousands of heterogeneous cells. In this design, a valve-based routing fabric is utilized as a crossbar to route a barcoding droplet from the input ports of the routing fabric to its output ports, from where it is transferred to the digital microfluidic part and mixed with sample/reagents droplets. This routing fabric is composed of transposers, which are connected using channels and controlled via pneumatic inputs.

The fault-tolerance of this routing fabric has been studied and a design technique for implementing a fault-tolerant crossbar has been proposed. However, prior work consideres only single failures. It was shown that this crossbar can be mapped to a flow network. Using this property, we will investigate the reliability of this design in the case of multiple failures in this work.

Tasks:

- Compare existing techniques for reliability analysis
- Introduce a method optimized for this particular architecture
- Implement the method
- Test on complex benchmarks

Requirements:

- Basic knowledge in C++ or Python
- Some experience in Object-oriented Programming
- Interest or experience in microfluidic biochips
- Interest in graph theory and flow networks
- Ability to work independantly and self-driven

Interested? Cool! I'm looking forward to talking to you!
Contact me by email: yasamin.moradi@tum.de