StackADrop: A Modular Digital Microfluidic Biochip Research Platform

Advances in microfluidic technologies have led to the emergence of *Digital Microfluidic Biochips* (DMFBs), which are capable of automating laboratory procedures in biochemistry and molecular biology [4]. These devices use *electrowetting on dielectric* (see [6]) to move small volumes of liquids in order to perform experiments.

In the last years, DMFBs raised significant attention in industry and academia creating a demand for readily available devices. Commercial products are available but come at a high price and are usually designed for few procedures only. So far, there are two open hardware DMFBs available: the *DropBot* from WheelerLabs [3] and the *OpenDrop* from GaudiLabs [1].

The aim of the StackADrop was to create a device with many directly addressable cells while still being very compact. To make the StackADrop as easy to assemble as possible, the droplet moving technique used is the single-plate configuration (see e.g. [5]).

The StackADrop strives to provide simple means to experiment with different hardware setups. The main feature for that are the exchangeable top plates. They support up to 256 high-voltage pins via four 64-pin rows at the edges. Furthermore, the StackADrop has SPI, UART and I2C connectors that allow to easily attach sensors or actuators to the device. Furthermore, a SWD debugging port is provided. StackADrop can be connected to a computer using USB if more computational power is required or for interactive sessions using a control software.

One use case of the modularity of the StackADrop is to easily analyze and test different cell shapes, such as the conventional squares, hexagons (see e.g. [8]) and triangles (proposed in [2]). Top plates for these shapes (see Fig. 2) have been manufactured and will be used to check theoretical results from [2] and [7].

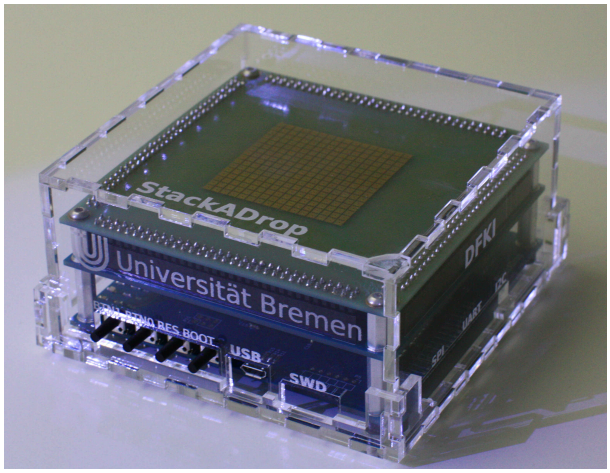

Fig. 1. View of the StackADrop DMFB prototype

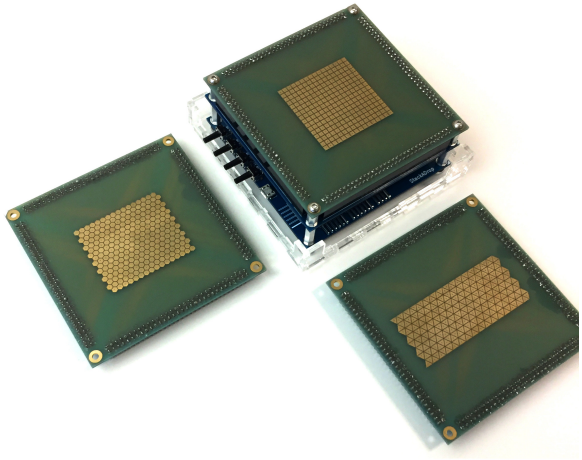

Fig. 2. StackADrop with three different PCB plates: squares (top), hexagons (left) and triangles (right)

References

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