



University of Liège
FACULTY OF APPLIED SCIENCES

Design of a dielectrophoretic sorting system applied to microfluidic droplets

*Master's thesis carried out to obtain the degree of Master of
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Abstract

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Single-cell resolution techniques have been implemented in recent times as an important leap forward in life-sciences research. In this context, microfluidic systems offer unique advantages compared to traditional flow cytometry approaches, mainly reduced associated costs, increased biocompatibility and versatility.

The company LiveDrop is developing a microfluidic-based instrument named Modaflow capable of microfluidic screening and single-cell sorting. It currently incorporates fluorescence-activated pneumatic valves at a micro-channel sorting junction to select cell-populated water droplets in a continuous flow of carrier oil. This thesis aims at replacing the pneumatic valves of this instrument by a dielectrophoresis-based sorter with the goal of increasing the maximum sorting frequency of the machine. This work first comprises a review of the main particle manipulation methods compatible with microfluidics, an introduction to dielectrophoresis (DEP) fundamentals, as well as a discussion and design of a system enabling DEP-based sorting. Empirical data and experiments are also presented and prove the sorting capabilities of the dielectrophoretic sorting system, with achieved sorting rates superior to 2000Hz.

Keywords: *single-cell manipulation, microfluidics, dielectrophoresis, high-throughput cell sorting*