

Experimental Study on Droplet Based Hybrid Microhandling Using High Speed Camera

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Abstract

Hybrid microhandling is a new approach in microhandling that combines the benefits of two major branches of microhandling: robotic micromanipulation and self-assembly under a unified framework. This paper presents an in depth experimental study of a hybrid microhandling technique that combines robotic micromanipulator and droplet self-alignment. The experimental study is carried out on a home-made microrobotics test platform adapted for the experiments. Three important aspects of the microhandling technique are investigated – the efficiency, reliability, and capability – through a series of tests. With the assistance of a high-speed camera, the duration and the trajectory of the droplet self-alignment process are studied. According to authors' knowledge, such results have not been previously reported. The experimental results also indicate that such a hybrid microhandling technique has very low requirements on the precision of the handling robot (comparable to the dimensions of the micropart) while being able to achieve micrometer precision. Part sizes ranging from 50 to 300 micrometers can achieve perfect assembly results. The experiments also show, for the first time, that parts having different sizes can be reliably assembled using the proposed hybrid microhandling technique.