# The limiting value of advancing contact angles on partially wetted surfaces

*Short Research Visit report-Yong Sung Park (Civil Engineering, University of Dundee)*

The SRV took place between 23 to 28th July 2018, in which Dr Yong Sung Park at Dundee visited Dr Yukie Tanino at Aberdeen. The purpose of the visit was to observe what happens when the interface of a drop of liquid on partially-wetting surfaces is forced to cross the critical value at which the local similarity solution for angular motion of free surface with a pinned contact line becomes singular. According to the analytical solution by Park (2016, 11th EFMC), the angular motion of the free surface near the moving contact line results in unbounded force at the angle about 128.7°. We were hoping to see a burst of capillary waves if the contact angle is forced to cross the critical value (either increasing from a smaller angle or decreasing from a larger angle), and we adapted Dr Tanino's microfluidic station (Figure 1) for the experiments.

A polished marble is submerged in oil, and water is injected by a syringe to form a droplet on the substrate. The piston of the syringe was driven at many different speeds in both upward and downward directions in order to observe increasing and decreasing contact angle (Figure 2).

However, there was no spectacular burst of capillary waves observed in any of the large number of cases. Undeterred by the disappointing results, we decided that in order to prove (or disprove) the theoretical limiting value of the moving contact angle, the detailed velocity field needs to be examined near the contact line at the critical angle. A larger-scale two-dimensional experiment with a substrate connected to an actuator moving around a free surface (or interface) would be desirable for the two-dimensional PIV experiments. We have started drafting a funding proposal for the experiments, and we look forward to reporting further results.

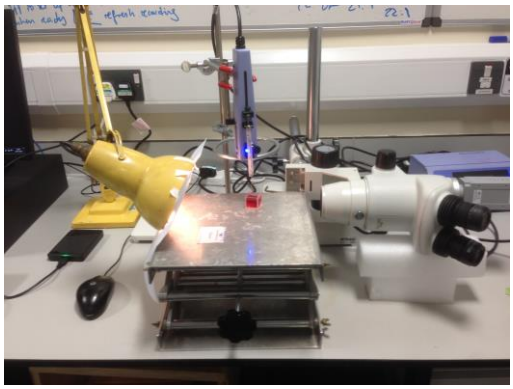

Figure 1. Microfluidic station consisting of a diffused back-lighting, a CCD camera with microscope, a syringe connected to a computer-controlled pump.

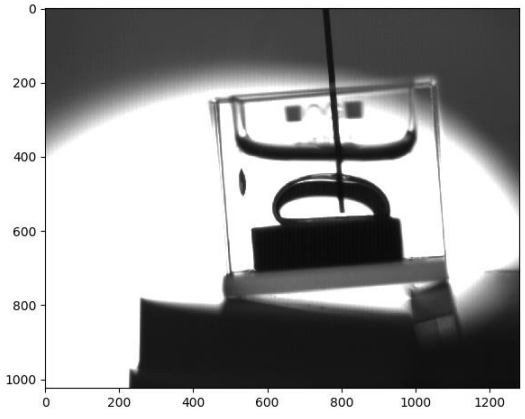


Figure 2. Moving contact line with increasing contact angle.