

Development of a robust open-source software for the automatic analysis of static and quasi-static contact angles

Raziyeh Akbari¹, Carlo Antonini¹

¹Department of Materials Science, University of Milano-Bicocca, Milano, Italy

raziyeh.akbari@unimib.it, carlo.antonini@unimib.it

Abstract Evaluation of contact angles is a crucial and primary measurement in the wetting studies. Considering the high number of frames to be analyzed during quasi-static measurements, e.g. for advancing and receding contact angle measurements, manual analysis of hundreds of frames is unsustainable. Here we present DropenVideo, developed after Dropen [1], a software for single drop image analysis developed in Matlab[®] environment and available in BOA, UNIMIB open repository. DropenVideo extends the frame-by-frame analysis of videos, to automatize the contact angle analysis process. In DropenVideo, each image is processed to identify and remove the needle, the substrate, and bright spots resulted from non-homogeneous lightening. After extracting the drop profile positions, the left and right contact points are determined automatically using a convolution mask. Contact angles are then computed using three different methods: convolution mask, circle, and polynomial fittings. As an additional feature compared to existing proprietary and commercial software, we propose a method for the automatic identification of advancing and receding contact angles, extracted as intersects of three lines, representing the fitting of data for three different wetting phases: (i) advancing phase, in which the contact diameter grows due to liquid inflation; (ii) stationary phase, corresponding to the initial phase of liquid retraction, in which the contact diameter remains constant; and (iii) receding phase, in which the contact diameter decreases. DropenVideo is currently available as beta version upon request to the authors and will be made available at BOA once fully validated.

Keywords: Wetting, Contact angle, Advancing and receding, Image analysis.

Subject area: Liquid drops and Interfaces.

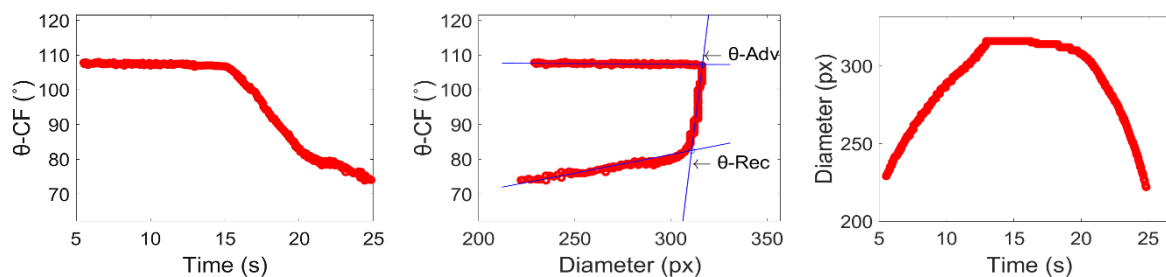


Figure 1. Left) Contact angle vs. evolution time for a quasi-static experiment, middle) fitting three straight lines into the three different wetting phases and extracting advancing and receding contact angles from the coincide of them, and right) drop contact diameter evolution during experiment.

References

- [1] Akbari R, Antonini C (2021) Contact angle measurements: From existing methods to an open-source tool. *Adv Colloid Interface Sci* 294:102470. <https://doi.org/10.1016/j.cis.2021.102470>