NUMERICAL SIMULATIONS OF INKJET PRINTING PROCESSES

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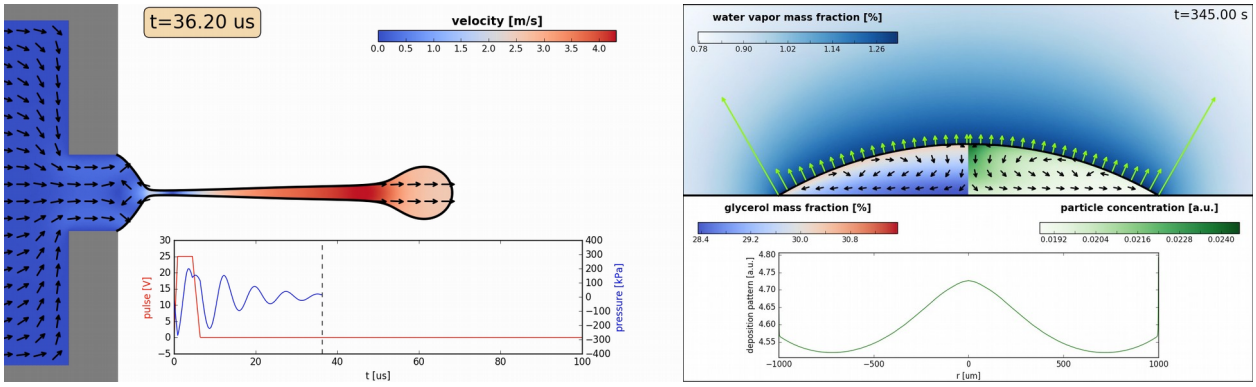
Nowadays, when you can easily order any kind of book or even customized photo books with a few clicks online, print-on-demand solutions become more and more important, for which ink-jet printing is an ideal candidate. This process, however, demands controlling the relevant processes, i.e. the jetting of droplets and the subsequent evaporation and absorption dynamics, which is even more complex due to the fact that ink is constituted of a mixture of different liquids, surfactants and pigments.

Using a sharp-interface ALE finite element method, we numerically investigate all the aspect relevant in ink-jet printing. We show how a short pause in jetting can result in clogged nozzles due to solvent evaporation and how mixture droplets evaporate and coalesce on the paper. Furthermore, the relevance of surfactants is addressed, helping to control the Marangoni flow to avoid undesired effects and leading to a perfect final printout.



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REFERENCES:

1. Li Y., Lv P., Diddens C., Tan H., Wijshoff H., Versluis M., Lohse D., 'Evaporation-triggered segregation of sessile binary droplets', Phys. Rev. Lett., **2018**, 120 (22), 224501.
2. Diddens C, 'Detailed finite element method modeling of evaporating multi-component droplets', J. Comput. Phys., **2017**, 340, 670-687.
2. Diddens C., Tan H., Lv P., Versluis M., Kuerten J.G.M., Zhang X. and Lohse D., 'Evaporating pure, binary and ternary droplets: thermal effects and axial symmetry breaking', J. Fluid Mech., **2017**, 823, 470-497.