Contribution ID: **219** Type: **Oral 20 Minutes**

Pore scale velocity measurements in 3D – measurements in empty flow channel

Thursday 17 May 2018 10:47 (15 minutes)

In this project we aim to measure flow velocities in porous media. We demonstrate our method in a rectangular flow channel, for which a semi-analytical solution of the flow field exists. The flow channel is made of borosilicate glass and its refractive index is matched with the fluid. Upon doping of the fluid with microspheres, those particles can be tracked to reveal the velocity field of the fluid. Our work is based on the general defocusing particle tracking method (Barnkob, et al., 2015). This method allows the tracking of microspheres in fluids in three dimensions based on 2D microscope images. We extended the method to account for overlaying particle images and for aberration in the microscope optics. Previously, the method has been applied to investigate flow within one relatively thin measurement slice of 1510 x 1270 x 160 µm3 (Barnkob, et al., 2015). We show that multiple measurement slices can be stacked together, to cover a measurement volume of 2550 x 1440 x 2000 µm3. The resolution at which particles can be tracked in this volume is below 1 µm in the x- and y dimension. The out-of-focus locations of particles can be reconstructed with an RMSE of ~3 µm.

This method can directly be applied for measurements in porous media if the refractive index of the fluid and the solid are matched. It allows for high-speed, high-resolution measurements of flow velocities. The temporal resolution of the method is solely limited by the frame rate of the camera. In our case this is 1000 fps at full resolution.

References
Barnkob, R., Kaehler, C. J., & Rossi, M. (2015). General defocusing particle tracking. Lab on a Chip(15), 3556–3560.

References

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