

# 1<sup>st</sup> Summer School on Complex Fluid-Flows in Microfluidics

PORTO, PORTUGAL  
JULY 10 – 14, 2017

The first edition of the “Summer School on Complex Fluid-Flows in Microfluidics” was held at the Faculty of Engineering of the University of Porto, Portugal from the 10<sup>th</sup> to the 14<sup>th</sup> of July 2017 sponsored by Anton Paar, Applied Sciences, BlackHole Lab, Elveflow, Formulation, and the Portuguese Society of Rheology (in alphabetical order). This 5-days course (6 hours/day) intended to provide cutting-edge knowledge on complex fluid-flow at microscale to those researchers working on microfluidics, complex fluids, or a combination of both. The content of the course tried to cover the three classical approaches, i.e. theoretical, experimental, and numerical to tackle scientific problems related with complex fluid-flows at microscale, having the following blocks/units: “Complex fluids and rheology in microfluidics” (F. J. Galin-

do-Rosales, CEFT/FEUP, Portugal), “Fabrication techniques in microfluidics” (S. Cardoso de Freitas, INESC-MN, Portugal), “Fluid-flow characterization in microfluidics” (L. Campo-Deaño, CEFT/FEUP), “Numerical simulations of complex fluid-flows at microscales” (A.M. Afonso, CEFT/FEUP), and “Numerical optimization in microfluidics” (K.E. Jensen, DTU/Nanoprobes, Denmark). The content of the course tried to cover the three classical approaches, i.e. theoretical, experimental and numerical, to tackle scientific problems related with complex fluid-flows at microscale. A book gathering the expertise of the chairs was especially edited for the occasion [1] and distributed among the participants, together with another book on applied rheology [2], which was kindly provided by Anton Paar.



Figure 1: Pictures at different moments of the course: a) A.M. Afonso during his lecture on numerical simulations in microfluidics, b) the participant Lucas Ribeiro de Azevedo talking about his current research activities, c) L. Campo-Deaño setting a flow visualization experiment at the microfluidics lab of the Transport Phenomena Research Centre, and d) K.E. Jensen and some participants during the laboratory session on numerical optimization in microfluidics.

The course was conceived and planned to be interactive and practical, thus 3 hours of lectures were provided during the morning sessions (Figure 1a) followed by a 3-hours hands-on/workshop slot during the afternoon sessions (Figure 1b-d), providing time enough for the presentations of some participants, visiting the microfluidic laboratory at the Transport Phenomena Research Centre, and solving some exercises in the computer laboratory. The course gathered 5 chairs and 35 participants from 11 different nationalities, 8 of which were selected for contributing actively to the content of the course (see Figure 2 for additional information).

Academic participants had the opportunity to make a 20 minutes presentations about their current research activities and setting forth their problem to the audience, who actively provided feedback and possible solutions, both during the time for questions and coffee breaks: Alberto Ponce Torres (Ph.D. student at University of Extremadura, Spain) “Anomalous behaviour of a viscoelastic pendant drop”, Arif Z. Nelson (Ph.D. student at University of Illinois Urbana-Champaign, United States) “Design of yield-stress fluids: A rheology-to-structure inverse problem”, Mónica Silva (Ph.D. student at University of Porto, Portugal) “Cleaning of medical devices with microslugs”, Emilio J. Vega (Assistant Professor at University of Extremadura, Spain) “Understanding the suppression of prompt splash with polymer additives”, Cássio Oishi (Assistant Professor at São Paulo State University, Brazil) “Numerical solution of viscoelastic multiphase flows”, and Lucas Ribeiro de Azevedo (Ph.D. student at TU Darmstadt, Germany) “An open source ‘strong’ non-Newtonian FSI solver implementation”. Participants from the industry enjoyed 90 minutes to talk about their products and latest developments for microfluidics applications, in order to compensate slightly the imbalance

situation between the number of representatives from the academia and industry in the event: Patrick Abgrall (R&D Project Manager at Formulation, France) “Fluidicam Rheo – Microfluidic Rheology”, Sebastien Cargou (CEO of BlackHole Lab, France) “Opening micro-fabrication for all!”, and “Elvesys Innovation Center, the microfluidic valley”.

As the numerus clausus (40 participants) was filled up before reaching the deadline for registrations, the course was also webcasted live. Attending to the awoken interest by this summer school, the number of seats for attending future editions will be increased. Looking forward to your participation at the 2<sup>nd</sup> Summer School on Complex Fluid-Flows in Microfluidics!

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**References**

- [1] Galindo-Rosales FJ (Ed.): Complex Fluid-Flows in Microfluidics, Springer, DOI 10.1007/978-3-319-59593-1 (2018).
- [2] Mezger TG: Applied Rheology – With Joe Flow on Rheology Road, Anton Paar (2014).

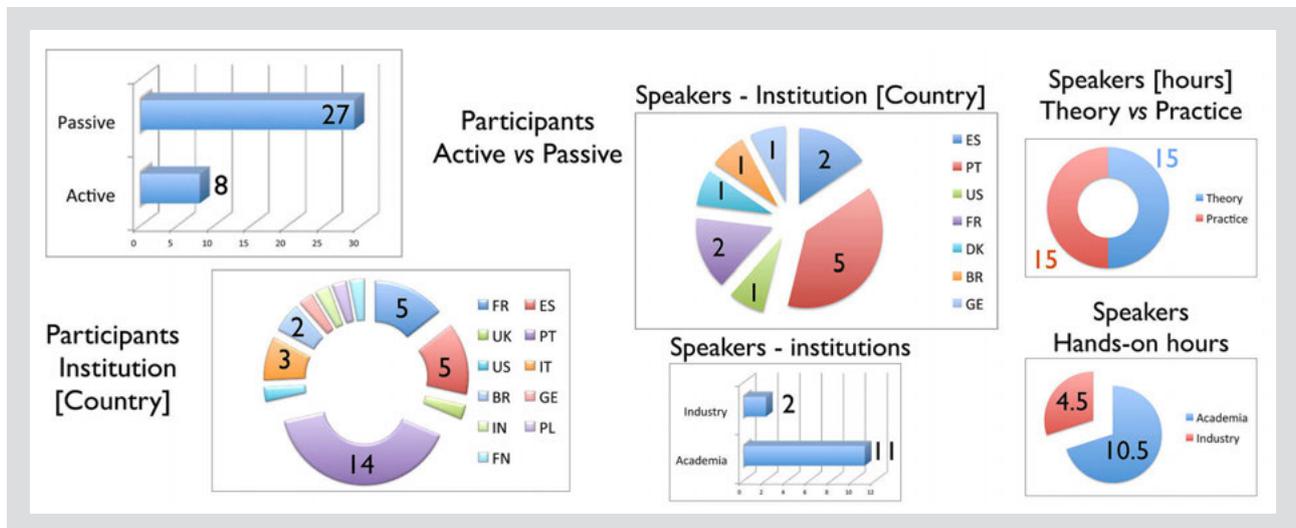


Figure 2: Some statistics about the participants and speakers during the event.