Fluid-Structure Interactions in Soft-Matter Systems: From the Mesoscale to the Macroscale

Prato, Italy
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The meeting "Fluid-Structure Interactions in Soft-Matter Systems: From the Mesoscale to the Macroscale'" was co-sponsored by Monash University (Melbourne, Australia) and the CECAM Node "Soft Matter and Statistical Mechanics" located in Mainz / Darmstadt / Stuttgart (Germany) and co-organized by Ravi Prakash Jagadeeshan (Monash) and Burkhard Dünweg (MPI for Polymer Research, Mainz). It took place during the last week of November 2012 at the Monash University Prato Center, which is an education and conference center, housed in the historic Palazzo Vaj in the old town of Prato, Tuscany, near Florence. The cast of participants was even more international than the organizational setting, with 20 delegates from Germany, 23 from other European countries, six from Australia, six from the United States, five from Eastern Asia, four from India, and two from the Middle East (in terms of affiliation).

Both organizers and participants viewed the meeting as highly successful and fruitful. We adopted a format that seems to be increasingly popular in the scientific community, i.e. a combination of an initial two-day school that was followed by a two-and-a-half day research workshop. The school provided a thorough introduction to "mesoscopic" computer simulation techniques and their theoretical understanding, featuring talks about the general "philosophy" of coarse-graining (A. Louis), Brownian Dynamics (J. Brady), Non-Equilibrium Molecular Dynamics (P. Daivis), Lattice Boltzmann (B. Dünweg, I. Ginzburg), Dissipative Particle Dynamics (F. Schmid), and Smoothed Particle Hydrodynamics (M. Ellero), while the more intricate and mathematical aspects of fluid-structure coupling were covered by lectures from the applied mathematics community (M. Lukacova, P. Anderson, A. Fogelson). The aim to bring researchers from different communities together – most notably from physics, mathematics and engineering – in order to foster cross-fertilization between disciplines, was also an overarching principle in the structure of the workshop, where novel theoretical results on the physics and mathematics of complex soft-matter systems involving flow or other non-equilibrium situations were presented. An important topic was the consistent treatment of thermal fluctuations, and their consequences for the movement of immersed particles (P. Espanol, A. Donev, R. Delgado-Buscalioni, M. Ellero, A. Wagner, F. Varnik). Significant progress in this field has been made possible through careful mathematical analysis combined with detailed numerical simulations. Multiphase flows and their (highly non-trivial!) modelling in a multitude of application settings was another broad topic (A. Fogelson, P. Anderson, T. Lee, J. Harting, F. Toschi, M. Sbragaglia). Colloid (H. Tanaka, R. Yamamoto) and polymer (S. Ansumali, J. Ravi Prakash) dynamics, although "classical" problems of soft-matter physics, still pose lots of unsolved questions, and simulational challenges. And yet oth-

Figure 1:
Group photo of the participants of the meeting.

er groups of researchers took up the even greater challenges of modeling the rheology of blood flow (D. Fedosov, S. Melchionna, M. Graham, M. Lukacova), and of active swimmers (M. Cates, J. Brady, G. Gompper, I. Pagonabarraga), through detailed simulations. This spectrum of topics was rounded off by reports on new developments in non-equilibrium statistical mechanics and micro-hydrodynamics (U. Seifert, P. Daivis, D. Bernhardt, J. Zhou), and on an in-depth formal understanding of fluid-structure coupling and of boundary conditions (I. Ginzburg, V. Sofonea).

Most of the remaining participants presented a poster, such that the meeting featured a very lively poster discussion session with altogether 31 posters, and subject matters as broadly distributed as in the oral sessions. Most talks (both at the school and at the workshop) were recorded, and readers interested in receiving electronic files should contact the organizers. All in all, it was a highly enjoyable and instructive meeting, and the organizers will perhaps try to run a similar conference in two or three years. The book of abstracts for both the talks and the posters is available via:
http://users.monash.edu.au/~rprakash/cecam_wrkshp/PratoBookOfAbstractsWebVersion.pdf

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