Interview with François Feuillebois

Maria L. Ekiel-Jeżewska: François, you have been investigating hydrodynamics of microparticles in viscous fluids for about forty years. How did you get motivated?

François Feuillebois: Under the guidance of André Lasek, I started as a PhD student to work in the field of suspensions. In 1972, he was back from DAMTP, Cambridge, UK, and asked me to read the now celebrated paper by Batchelor on sedimentation [1]. I then engaged to work on sedimentation and various other problems for suspensions. As an example, after staying as a post-doc in the group of Batchelor at Cambridge, I derived theoretical results for inhomogeneous sedimentation [2].

Was the personal contact with Batchelor essential for your scientific development?

Indeed, when George Batchelor visited the CNRS Aérothermique lab in Meudon before I went to Cambridge, I was starting on the sedimentation problem and he gave me some precious hints. When at DAMTP, Cambridge, he offered me to work on the problem of inhomogeneous sedimentation at the top of a settling cloud of particles, a difficult problem indeed. I then also benefited from useful discussions with him and his collaborators, namely John Hinch, David Jeffrey, John Rallison.

How has it later happened that you have extensively collaborated with Polish scientists, and visited Poland so often?

Thanks to André Lasek who was originally from Poland, I also knew about the Biennial Fluid Mechanics Conferences organised by Professor Fiszdon in Poland. I attended the ones in Białowieża (1975), Błażejewko (1979), Jachranka (1981), Sobieszewo (1985), Mrągowo (1987), Kozubnik (1989) and then in Warsaw (1992). During these symposia, I had the occasion to meet various colleagues, in particular from Poland and Bulgaria, with whom I continued thereafter an extensive collaboration. The present symposium is following a long fruitful collaboration with IPPT PAN [3], in particular with yourself, and I am grateful for this collaboration.

Why did you attend so many conferences in Poland?

At that time, these conferences were one of the very few opportunities for scientists of eastern Europe to meet those of western Europe, and conversely. Apart from the high level in fluid mechanics, there was a very friendly and informal atmosphere when people realised that, in some unknown little place somewhere in Poland, the only possibilities were to discuss and then enjoy come-together evenings.
What happened later with the tradition of the Biennial Fluid Mechanics Conferences?

The Fiszdon’s conferences transformed into the Euromech Fluid Mechanics conferences when frontiers of eastern countries opened. I also attended the 1st Euromech Fluid Mechanics conference in Cambridge in 1991 and the 2nd one in Warsaw in 1994.

Although Professor Fiszdon was known in the international fluid community as the organiser of the Biennial Fluid Mechanics Conferences [4], but he considered educating a few people as the only own achievement [5]. What has been your contribution to education of next generations?

In the late nineties, when I visited Professor Fiszdon at home after his accident, the main question that he asked me was whether I had some PhD students. When I told him I had several at a time, he told me something like: “Oh yes, this is what I liked as well”. Indeed, for Professor Fiszdon, supervising PhD students was the achievement. Today, I am happy to have been a guide for 25 PhD students who had themselves afterwards professional achievements. Also, when supervising them, they continuously provided me with an impulse to go further.

Could you tell young researchers how to succeed? How had you got motivated to persist in working on research problems, which you finally solved?

An interesting theoretical problem is one which may first appear as a paradox. In 1972, I wondered why do two spheres settle faster than one and many dispersed spheres in a container settle slower. But one is not always lucky in finding such a “paradox”. In any case, the domain of fluid mechanics at micro-scales is rich with applications, in the meteorology of clouds, in analytical chemistry, etc. and discussions with colleagues familiar with such applications have been for me a continuing source of inspiration. I think that advances in difficult problems (typically like sedimentation, which is not fully solved today, in despite of recent advances published by colleagues in the present volume) deserve techniques which are novel for fluid mechanics, even though they may be well known in other scientific domains. For instance, the calculations in Ref. [2] were done after I learned some basis of the theory of distributions. Various experimental papers were connected to “novel” appropriate techniques, in collaboration with colleagues who are specialists of them; for instance, the measurement of the average velocity of sedimentation using X-ray absorption [6], the measurement of hydrodynamic interactions between spheres at contact using interferometry, one rough moving sphere being a reflector, see the paper [7] (following a collaboration with D. Joyeux at Institute of Optics, Orsay, in 1987-1991). More recently, the Aris-Taylor dispersion with a slip wall (see my paper herein) was solved for interpreting results of the novel Double-Focus Fluorescence Cross-Correlation technique to measure the slip length [8].

Well, do you think that progress is based on linking theory to experiments, and on collaboration with scientists of a different experience?

I realised that there are two basic approaches in fundamental science. One is advancing in theory and trying afterwards to set up an experiment which can verify it. Another one is to find with a simple experiment a new phenomenon and thereafter try to model it. Both approaches have their interest and both are used by colleagues. I tend to use the first one, favouring theory and collaborating with colleagues, in particular for experiments.

In your opinion, what are nowadays the fundamental open problems in microhydrodynamics, and how to search for solving them?
Microhydrodynamics is nowadays a rapidly evolving field with the new devices in microfluidics, etc. So some ideas that we have today may soon become obsolete. We can consider for instance micro-devices in which there are not only straight pipes but also a number of connections. For these sizes, low Reynolds number analysis may be possible, not only at first order (Stokes flow) but also at second order (with some fluid inertia), perhaps considering also slip on walls. The motion of fluid-fluid interfaces in such devices is also of importance. Keeping aware of the evolution in this field is certainly a continuing source of inspiration.

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[3] Feuillebois F and Ekiel-Jeżewska M L 2010 Suspensions de particules et interactions hydrodynamiques dans un fluide visqueux Annales, Centre Scientifique de l’Académie Polonaise de Sciences 12 44–61 (http://www.academie-polonaise.org/index.php?option=com_content&view=category&layout=blog&id=60&Itemid=66&lang=fr).
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