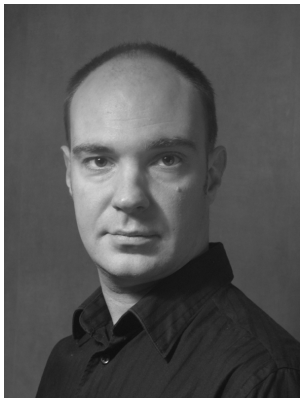

Philippe Poncet, Maître de conférences

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Biography

2007 : Habilitation to supervise research

2003 : MIT Fellowship Award

2002 : Permanent position at the National Institute of Applied Sciences (Toulouse)

2001 : PhD in Applied Mathematics, University Joseph Fourier (Grenoble I, France)

1998 : Master Degree in Applied Mathematics

1973 : Born in Strasbourg, France

Interest and ongoing work

My work focuses mainly on scientific computing related to complex three-dimensional flows. My goal is to build mixed Eulerian-Lagrangian numerical methods, that is to say hybrid grid-particle schemes, aiming at computing flows in complex geometries and/or with complex boundary conditions. Most of this work is related to vorticity dynamics and direct numerical simulation of Navier-Stokes equations.

Applications have been computation of three-dimensional wakes [5], identification of aerodynamic instabilities and bifurcations in flow topologies [4], and flow control [1]. Some aspects recently investigated are multi-scale grid techniques for vortical Lagrangian methods, and the use of fundamental solutions in the boundary neighborhood in order to handle slip and no-slip flows [2].

Applications under development involve health science, such as understanding breathing mechanisms, air dynamics in lungs and air-mucus interactions. In the future, investigating with these methods flows of complex rheology, such as blood, may be interesting, given some recent results on Lagrangian computation of non-linear viscosity [3].

During this symposium, I would like to focus on challenges in fluid computation for health science, related to operational problems and geometries, and availability of real-life data and parameters. Also, I would appreciate discussions on new available numerical tools and achievements, such as technological limits and scalability.

Selected publications

[1] P. Poncet, R. Hildebrand, G-H. Cottet and P. Koumoutsakos, *Spatially distributed control for optimal drag reduction of the flow past a circular cylinder*, J. Fluid Mech. , 599, 111–120 (2008).

[2] P. Poncet, *Analysis of direct three-dimensional parabolic panel methods*. SIAM J. Numer. Anal. 45(6), 2259–2297 (2007).

[3] P. Poncet, *Finite difference stencils based on particle strength exchange schemes for improvement of vortex methods*, J. Turbulence 7 (23), 1–24 (2006).

[4] P. Poncet, *Topological aspects of the three-dimensional wake behind rotary oscillating circular cylinder.* J. Fluid Mech. , 517, 27–53 (2004).

[5] G-H. Cottet and P. Poncet, *Advances in Direct Numerical Simulations of three-dimensional wall-bounded flows by Particle in Cell methods.* J. Comp. Phys., 193, 136–158 (2003).