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Symposium Penalization and Applications

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SUMMARY

Session opening : *Ph. Poncet.*
This symposium deals with numerical and theoretical aspects of penalization techniques.

Talk 1 : *Penalization for viscous flow around a porous thin layer (G. Carbou [1])*
We study a penalization method used to compute the flow of a viscous fluid around a thin layer of porous material. Using a BKW method, we perform an asymptotic expansion of the solution when a little parameter, measuring the thickness of the thin layer and the inverse of the penalization coefficient, tends to zero. We compare then this numerical method with a Brinkman model for the flow around a porous thin layer.

Talk 2 : *Penalized variable viscosity 3D Stokes equations (D. Sanchez [2, 3])*
The analysis of the penalized Stokes problem, in its variable viscosity formulation, coupled to convection-diffusion equations is presented in this here. It models the interaction between a highly viscous fluid with variable viscosity and immersed moving and deformable obstacles.

Talk 3 : *Multiple swimmers using penalization in deforming geometries (Ph. Chatelain [4])*
We present a vortex particle method coupled with a penalization technique to simulate single and multiple swimmers in an incompressible, viscous flow in two and three dimensions. The proposed algorithm can handle arbitrarily deforming bodies and their corresponding non-divergence free deformation velocity fields.

Keywords: Penalization, Asymptotic analysis, Applications, Porous media.

References

[1] G. Carbou, Penalization method for viscous incompressible flow around a porous thin layer, Nonlinear Anal. Real World Appl. 5(5), 815–855 (2004).

[2] R. Chatelin, P. Poncet, *Hybrid grid-particle methods and Penalization : A Sherman-Morrison-Woodbury approach to compute 3D viscous flows using FFT*, J. Comput. Phys. 269, 314-328, 2014.

[3] R. Chatelin, D. Sanchez, P. Poncet, *Analysis of penalized variable viscosity 3D Stokes equations coupled to diffusion and transport*, submitted.

[4] M. Gazzola, P. Chatelain, W. M. van Rees, and P. Koumoutsakos, *Simulations of single and multiple swimmers with non-divergence free deforming geometries*, J. Comput. Phys. 230(19), 7093–7114, 2011.

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