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Transport and pore scale modeling of porous media

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SUMMARY

Running simulations within porous material often requires high resolution meshes and data, to get all the information at microscopic scale. We will expose some results aiming performing high resolution simulations, with the help of moderate computational resources.

Our studies are based on the use of hybrid methods called Euler-Lagrange methods [2]. This kind of methods allow to compute the velocity field u on a fixed (often cartesian) grid, derived from the Stokes equation. The quantity of interest α (for instance, a mass-concentration) is carried by particles, and is advected by the help of velocity information. This information exchange between grid and particles is performed through interpolation techniques [3].

The particle transport and the interpolation between grids and particles are linear in complexity, hence the necessity to have an efficient 3D Stokes solver. In order to treat 3D real cases at high resolution, we will discuss how to satisfy some boundary conditions at the fluid-solid interface, like slipping conditions to model a rough wall. We will compare different methods (penalization techniques [1], immersed boundaries, vortex methods), considering how suited these techniques are for big amount of geometric data.

Keywords: Porous media, Hybrid methods, Interpolation, Roughness, Penalization

References

[1] G. Carbou. Brinkmann model and double penalization method for the flow around a porous thin layer. *Journal of Mathematical Fluid Mechanics*, **10**, 126–158, 2008.

[2] R. Chatelin and P. Poncet. A particle method for moving bodies in a 3D Stokes flow with variable viscosity. *SIAM Journal of Scientific Computing*, **35**(4), 925–949, 2013.

[3] J.J. Monaghan. Extrapolating B-Splines for interpolation. *Journal of Computational Physics*, **60**, 253–262, 1985.

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