Domain continuity for the Euler and Navier-Stokes equations

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The aim of the talk is to understand the effect of rough walls or rough obstacles on fluid flows. It has various physical motivations, including drag reduction in microfluidics. Mathematically, there are two natural ways to model the roughness:

1. by considering fluid domains with non-smooth boundaries.
2. by considering fluid domains with oscillating boundaries, the oscillation being of small amplitude and wavelength.

The first model often raises numerical and mathematical difficulties (like a lack of Cauchy theory), which requires to consider smooth approximations Ω^ε of the irregular domain Ω^0. As regards the second model, denoting by ε the small wavelength or amplitude of the oscillating boundary, one is also led to consider a sequence of domains Ω^ε parametrized by ε.

This leads naturally to questions of domain continuity for fluid models, broadly: if Ω^ε converges to Ω^0, does the associated fluid velocity u^ε converge to u^0 ? Are the boundary conditions preserved in the limit ?

We shall investigate these questions in the context of the Euler and Navier-Stokes equations.

References

[1] Anne-Laure Dalibard and David Gerard-Varet, Effective Boundary conditions at a rough surface starting from a slip condition, *Journal of Differential equations*, **Volume no. 251** (2011), pp. 3450-3487

[2] David Gerard-Varet and Christophe Lacave, The 2D Euler equations on singular domains, Preprint 2012.

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