Date :: 2013 July 3, 2:00pm

Place :: Seminars Room of DMA (B4009), Campus of Gualtar

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Title :: Stokes and Navier-Stokes equations with different boundary conditions

Abstract :: We consider here elliptical systems as Stokes and Navier-Stokes problems in a bounded domain, eventually multiply connected, whose boundary consists of multi-connected components. We investigate the solvability in L^p theory, with $1 < p < \infty$, under the non standard boundary conditions

$$\boldsymbol{u} \cdot \mathbf{n} = g \quad \text{and} \quad \mathbf{curl}\, \boldsymbol{u} \times \mathbf{n} = \mathbf{h} \qquad \text{or} \qquad \boldsymbol{u} \times \mathbf{n} = \mathbf{g} \quad \text{and} \quad \pi = \pi_* \quad \text{on}\, \Gamma,$$

or

$$\mathbf{u} \cdot \mathbf{n} = g \quad \text{and} \quad 2\,[\mathbf{D}(\mathbf{u})\mathbf{n}]_{\boldsymbol{\tau}} + \alpha \mathbf{u}_{\boldsymbol{\tau}} = \mathbf{h} \quad \text{on}\, \Gamma.$$

where α is a friction coefficient and $\mathbf{D}(\mathbf{u})$ denotes the stress tensor $\mathbf{D}(\mathbf{u}) = \frac{1}{2}(\nabla \mathbf{u} + \nabla \mathbf{u}^\top)$. The main ingredients for this solvability are given by the Inf-Sup conditions, some Sobolev's inequalities for vector fields and the theory of vector potentials satisfying

$$\boldsymbol{\psi} \cdot \mathbf{n} = 0, \quad \text{or} \quad \boldsymbol{\psi} \times \mathbf{n} = \mathbf{0} \quad \text{on}\, \Gamma.$$

Those inequalities play a fundamental key and are obtained thanks to Calderon-Zygmund inequalities and integral representations.
In the study of ellpitical problems, we consider both generalized solutions and strong solutions that very weak solutions.
In a second part, we will consider the nonstationary case for the Stokes equations.