The splitted Do-Nothing Type of Boundary Condition for Navier-Stokes Equations in Cascade of Profiles, the Existence and Uniqueness of a Weak Solution

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ABSTRACT

We are concerned with the theoretical analysis of the model of incompressible, viscous, stationary flow through a plane cascade of profiles. The boundary value problem for the Navier-Stokes system is formulated in a domain representing the exterior to an infinite row of profiles, periodically spaced in one direction. Then the problem is reformulated in a bounded domain of the form of one space period and completed by the Dirichlet boundary condition on the inlet and the profile, a suitable natural boundary condition on the outlet and periodic boundary conditions on artificial cuts. Specially, we derive and study the question of existence and uniqueness of the weak solution of this problem for linear separated "do nothing" type boundary condition (which we derive)

$$q = h_1, \qquad -\nu\,\omega(\boldsymbol{u}) = h_2, \tag{1}$$

where q is total pressure and $\omega($**u** is the vorticity of the flow. The difference to the basic do nothing boundary condition developed in [1] is discussed and compared.

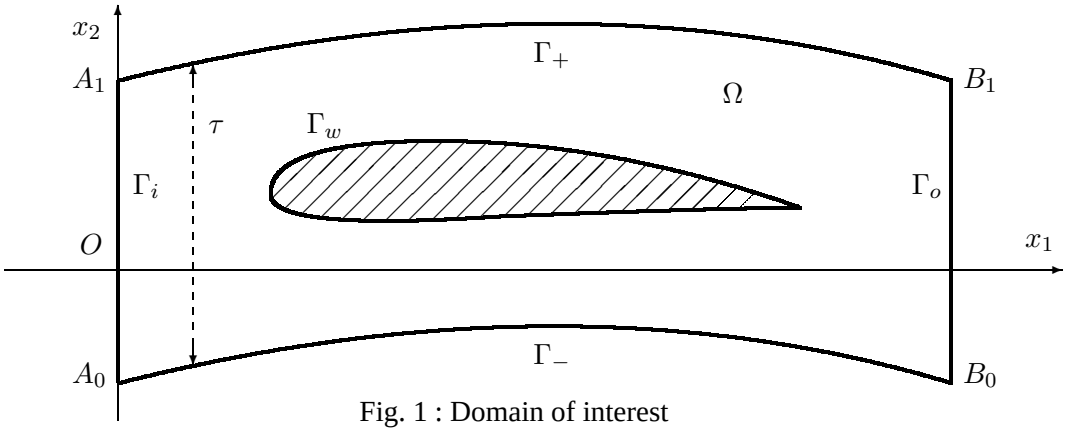

Fig. 1 : Domain of interest

References

[1] Heywood J. G., Rannacher R. and Turek S.: Artificial boundaries and flux and pressure conditions for the incompressible Navier-Stokes equations. Int. J. for Numerical Methods in Fluids 22, 325–352 (1996).