SIMULATION AND CALCULATION OF VARIOUS PARAMETERS OF A LIQUID FLOW IN CONDUITS WITH COMPLEX SECTION, BY THE FINITE ELEMENT METHOD

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Abstract:

The present study, gives to the engineer who is face to the installation or the use of the conduits, the knowledge which will allow him in first part, to understand the studies realized by the specialists to which he can be exposed, and in others parts, to use these conduits correctly by knowing the phenomena and the constraints which made it possible to realize them, as well as the practical methods of study of the conduits according to the conditions of flow of the fluids transported.

Thus, our principal object is the study of the viscous, laminar and incompressible flow in conduits of complex section, by the finite element method, by basing on the generalization of the Poiseuille flow witch is theoretically study by *Stocks* for circular and plane sections, in order to determine numerically the fields of the thermodynamic and dynamic parameters through these sections.

Indeed, the complexity of the sections of the studied conduits induced that the analytical solution (exact) does not exist, and obviously, our interest is directed towards the search for the approximate numerical solutions.

The equations which control these flows in the general case, are complex and nolinear, but with suitable assumptions for our study, these equations are reduced to the differential equation of *Poisson* with second constant member, the solution of the equation represents the distribution of the axial velocity through the section of control, and the boundary conditions of the studied problem are of *Dirichlet* type, considering the presence of the viscosity of the fluid and the forces of friction with walls.

The finite element method was applied successfully since it adapts for any section chosen, while being based on an iterative representation, which uses the method of *Khaletski* for the resolution of system.

The solution of the system gives us the distribution of velocity through the section chosen, and once this speed is given, we can deduce from them the thermodynamic and dynamic parameters such as the pressure, the speed max, the volume flow, the force friction to exert on the wall, as well as the shear stress.

However, once this work is realized for a section quite selected such as the circular section,

we can contribute with complex sections, and, since the analytical solution exists for some geometry such as the rectangular and elliptic sections, a validation will make the object of a comparison between these solutions and the results obtained by our developed data-processing program, in order to pass to other more complex simulations.

These results allow, for example for engines constructor or another type of installation, and in particular when they are interested in modifications of conduits, to have the results and the data necessary according to the geometry of the selected conduits.

Key words: conduits; finite elements; simulation; viscous and incompressible fluid.