PRACTICAL METHODS OF THE GEOMETRY DESIGN AND GRID GENERATION FOR SOLUTION OF 3-D FLUID DYNAMICS PROBLEMS

Yu.D. Shevelev

The Institute for Computer Aided Design of Russian Academy of Sciences
19/18, 2nd Brestskaya, Moscow 123056, Russia

shevelev@icad.org.ru

a) One of the basic problems at the fluid dynamics computation is creation of the most full models of geometry. In this paper the various methods of geometry design of the complete real configuration (/1- 3, 5/) will be considered. The process depends on the initial data information. If the information is given by data then it is usual problem of interpolation. The traditional techniques of geometry design used: global and local interpolation methods, the spline's interpolation, NURBS and algebraic methods.

At the first stage it is especially important to construct the model that is taking into account the main design parameters- *baseline approximation*. It is convenient to set a surface analytically. Advantage of such technique consists in that it can be used at all design levels. The geometries are presented as set of elements of geometry (for example, a fuselage, wings, etc.). Each of elements of a surface consists on compartments. A compartment may be expressed through geometrical parameters of cross section, for example, a wing: thickness, chord of section, curvature, etc. Such configurations are made from separate parts and each part imposes the certain restrictions on aerodynamic characteristics. The analytical form of presentation gives you an opportunity to define a surface by finite number of parameters. This approach is useful for optimization problems.

The spline's interpolation techniques are more universal. Surface representations used the cubic B-splines and supported a data structure to represent all geometric primitives with desirable properties as local control, convex shape preserving forms, etc. The spline's interpolation techniques give us a minimum error for a special class of functions and interpolate derivatives. The interpolation is insensitive to the disturbances of the initial dates. The main ideas are implemented in the ACAD system (design system for aerodynamic purposes).

b) The co-ordinates systems of fluid dynamics problems have the several particular features: a predominant direction, plane of symmetry, one coordinate may be constant on surface. In our practice we had been used algebraic, differential, conform mapping techniques of grid generation. Specific of studied problems dictates to use the different methods. The physical region is divided into sub-regions and within each sub-region a structured grid is generated. Structured block grid formed by a network of curvilinear coordinate lines such that a one-to-one mapping can be established between the physical and computational domains. The curvilinear grid points conform to the boundaries, surfaces, or both and therefore provide the most accurate way of specifying the boundary condition.

The grid must takes into account geometrical and physical features of the flow field. A mesh must highly specialize for the particular problems (resolving the boundary and shear layers, shocks, wakes and so on). The accuracy of computations depends on the mesh size of grid spacing in real space and the ability to control a physical mesh point's distribution. The grid adaptation is achieved by moving the grid points and refinement. The redistribution has been the favored approach with block-structured grids. Size of mesh spacing near wall depends on Reynolds number. Just body fitted coordinate system can correctly resolved the viscous effect.

c) For solution of some concrete problems a conformal mapping permits the sufficient preferences. Theory of 2-D conformal mapping describes by analytical function theory of one complex variable. It is well known that the 2-D conformal mapping does not generalize to 3-D case. From point of view of grid generation we don't need the fulfillment of all advantages of 2-D conformal mapping in 3-D case. We can consider a mapping that forms a subclass of the class of quasi-regular mappings. The 3-D analogue of 2-D conformal mapping is considered. Then we studied a concept of quasi-potential 3-D transformations as an analogy of 2-D conformal transformations. The governing equations for steady potential flows of an incompressible fluid used. The coordinates system are formed by families of velocity potential surfaces and two streamline functions. The common solution is formally obtained. Perspective of using quasi-conformal mapping in (4-D) common case will be considered.

Finally it is displayed some of the applications, particularly to flows past prototypes of real configurations. Solutions of flow problems past "Soyuz", "Mars", "Buran" and RVL (Reusable Launch Vehicle) and others will be presented.

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