FLOWVISION – CAE-SYSTEM FOR SIMULATING NUCLEAR INDUSTRY TASKS

A. A. Aksenov

«TESIS», Moscow, Russia

JIHT RAS, Moscow, Russia

The FlowVision software package [1] is designed for numerical modeling in the design of various technical objects in various industries, including space rocket, aviation and automotive engineering, as well as the nuclear industry. Numerical modeling tasks in these areas require an integrated interdisciplinary approach that takes into account and interacts with various physical processes. Currently FlowVision has mathematical models of heat and mass transfer and fluid motion (Navier-Stokes equations) implemented for three-dimensional, incompressible and compressible flows [2], Newtonian and non-Newtonian fluids. FlowVision also has the ability to numerically solve unsteady Maxwell equations for modeling electric current and electromagnetic fields in a continuous medium, modeling the motion of gas discharges, model radiation heat transfer, model the motion of dispersed phase (bubbles, droplets, grains), calculate the sources of aeroacoustics and propagation of acoustic waves in the medium. FlowVision has tools for modeling complex flows – among them sliding surfaces for rotating machines (turbines, compressors, pumps), modeling of immiscible liquids with contact surfaces, motion of bodies relative a static computational domain.

FlowVision models turbulence using two different approaches. The first approach is based on the averaged Reynolds equations (RANS approach). The second approach is a vortex resolution method using implicit large eddy simulation (ILES) or subgrid turbulence modeling using the Smagorinsky model. To improve the accuracy of vortex-resolution calculations, FlowVision includes the inclusion of a beveled scheme to approximate convective flows.

The application of FlowVision to aerodynamic computational problems in aeronautical engineering imposes the requirement of boundary layer resolution to obtain $y+ < 1$ with a prismatic boundary mesh. FlowVision also allows the modeling of aircraft, propeller and engine compressor icing, taking into account the operation of the de-icing system in constant or pulsed mode [3].

For modeling of strong fluid-structure interaction FlowVision has integration with various finite element codes (Zenith, APM, Fidesis, Abaqus, Nastran, Euler), which allow to calculate the stress-strain state of structures.

The work shows various practical applications of FlowVision in the nuclear industry

References

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