SOFTWARE SigmaFlow FOR SIMULATION OF ENERGY PROCESSES

Description

The SigmaFlow software is developed for numerical simulation of hydrodynamic processes, complex heat and mass transfer. The numerical method is based on the finite-volume method for structured multiblock nets. The applied unorthogonal curvilinear nets combined with the boundary of calculation domain allow modeling for processes in geometrically complex objects. The schemes of a high accuracy order are used for approximation of differential equations. Nonlinear interconnection between the fields of physical parameters (temperature, velocity, pressure, density, etc.) is described by original disintegration procedures, which allow implementation of economically stable algorithms.

Using these methods, there were obtained the software modules, which allow modeling for:
- spatial stationary liquid and gas flows;
- laminar and turbulent flows;
- flows in porous media;
- chemical reactions and mixing processes in the multicomponent mixtures;
- combustion of gaseous, liquid and solid fuel;
- convective, conductive and radiant heat transfer;
- motion of a dispersed phase in the carrying flow (solid particles and droplets);
- processes of drying and pyrolysis, chemical reactions of a dispersed phase;
- flows with volumetric forces.

The software SigmaFlow includes the main structural elements typical for “heavy” universal CFD (Computational Fluid Dynamics) complexes. This is the software for development of geometry and computational grid; formation of boundary conditions; choice of physical models and solver adjustment; calculation and monitoring of problem convergence; visual analysis of modeling results.

Fig.1. Sample simulations using the SigmaFlow software.
**Technical appraisal and economic benefits**

The SigmaFlow software is a universal authoring CFD complex, which can be upgraded (improvement of physical-chemical and mathematical models) and used for development of specialized dedicated software products.

**Application areas**

The software is intended for investigation of a wide scope of hydrodynamic and thermal physical processes and optimization of technological equipment at the objects of heat and power engineering, hydropower industry and nuclear power engineering.

The developed SigmaFlow software allows us simulations for the processes of hydrodynamics, heat and mass transfer, chemical reacting, flame combustion of gaseous and solid fuels.

**Development stage**

The team has accumulated a great experience in calculation of applied problems of power engineering: modeling of aerodynamics, combustion and heat transfer in furnaces of boiler units; investigation of gas flows in gas pipe systems, optimization modeling aimed at reduction of ecologically harmful emissions; calculation optimization of burners for combustion of coal-dust fuels; modeling of powder-gas flows in cyclones and separators; study of the flow structure and analysis of energy characteristics of hydroturbine passages; parametrical investigation of elements of heat-hydraulic passages of nuclear power plants.

**Patent situation**

Certificate of official registration of PC software No. 2005612831 Sigma-Furnace. It is registered in the Software registration book on November 1, 2005.

**Commercial offers**

Development of specialized dedicated software Sigma Flow is suggested. This includes:

- calculations in Consumer’s problem domain;
- adaptation of physical-mathematical models;
- development of specialized software, intended for the specialist-technologist;
- software delivery;
- software mastering.

**Estimated cost**

Contractual price.

**Contacts**

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