*Materials of Conferences*

## COGNITIVE APPROACH IN COMPUTATIONAL AERODYNAMICS

Khlopkov Yu.I., Zay Yar Myo Myint, Khlopkov A.Yu.

*Department of Aeromechanics and Flight Engineering, Moscow Institute of Physics and Technology, Zhukovsky, Russia*

The beginning of cognitive science was in 1960. Cognitive technology in computer science is combination of methods, algorithms and software for modeling the cognitive abilities of the human brain to solve specific application problems [1, 2]. Cognitive technologies based on the achievements of scientific disciplines (mathematics, artificial intelligence and data mining, information technology), and largely invariant with respect to the subject area. For example – recognition; identifying patterns in the data; solving computer-aided design of complex systems; decision support systems with fuzzy input; etc. In the last century, the founders of cybernetics Alexander Bogdanov, Norbert Wiener, John Von Neumann formulated the idea of the combining a computer with human abilities. Cognitive technologies based on the achievements of scientific disciplines (mathematics, artificial intelligence and data mining, information technology), and largely invariant with respect to the subject area. This approach has been practically implemented for the development of nuclear energy for military and peaceful purposes (Los Alamos, Arzamas-16). To reduce project time and the number of expensive full-scale and experiments specialized the computer systems such as Knowledge Based Engineering, Computer Aided Engineering. The models are based on the "Physics" [3].

Numerical methods have considerable complexity. These reasons are complicated the possibility of preliminary design stage, which is considered a lot of options. Therefore, models based on a cognitive approach become natural. They are built on the basis of scientific and intuitive analysis of data obtained by means of theoretical, experimental, numerical studies. In addition, the specialist should have a basic knowledge of the construction and analysis of numerical algorithms, the planning computational experiments and at least one programming language.

The reported study was partially supported by the Russian Foundation for Basic Research (Research project No. 14-07-00564-a).

**References**

1. Review of NASA's Aerospace Technology Enterprise: An Assessment of NASA's Pioneering Revolutionary Technology Program. National Academies Press, 2004.

2. Ron Sun The Cambridge Handbook of Computational Psychology. Introduction to Computational Cognitive Modeling, Cambridge University Press, 2008. pp. 3-20.

3. Belotserkovskii O.M., Khlopkov Yu.I. Monte Carlo Methods in Mechanics of Fluid and Gas, World Scientific Publishing Co. N-Y, London, Singapore, Beijing, Hong Kong, 2010.

---

The work is submitted to the International Scientific Conference "MODERN HIGH TECHNOLOGIES", Israel, April25 -2 May, 2014, came to the editorial office on 02.04.2014

## MATHEMATICAL MODELING OF AEROTHERMODYNAMIC CHARACTERISTICS FOR HYPERSONIC VEHICLES

Khlopkov Yu.I., Zharov V.A., Khlopkov A.Yu., Zay Yar Myo Myint

*Department of Aeromechanics and Flight Engineering, Moscow Institute of Physics and Technology, Zhukovsky, Russia*

The modeling of high-speed flows stipulates also the compliance with other similarity criteria, which includes first of all the criteria of Mach numbers (M) and Reynolds numbers (Re), as well as ensuring the low level of turbulence and flow homogeneity in the facility working section. The method of model fixation also influences significantly the accuracy of the experiment. The simultaneous solution of these problems within one experimental facility seems to be impossible. In the extreme case of free-molecular flow, the integral of collisions in the Boltzmann equation becomes zero, and its general solution is a boundary function of distribution, which remains constant along the paths of particles [1]. In the transitional regime, the most suitable method to compute heat transfer coefficient of hypersonic vehicle relies on bridging formulae [2]. In order to determine the force action and heat action of the gas on the body, it is sufficient to know local exchange coefficients of impulse and energy.