Materials of Conferences

KINETIC EQUATIONS FOR THE TRIPLE COLLISIONS OF MOLECULES

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State of gas determined by interaction of molecules each other and with the boundaries of the solid or liquid bodies. The concept of elastic collisions play an important role in physics, as collisions often have to deal with physical experiment in the field of atomic phenomena. The interaction of particles may be a variety of processes. The process of collision is to change the properties of the particles as a result of interaction. Conservation laws provide an easy way to set the ratio between the various physical quantities in the collision of particles [1]. In this paper we consider the interaction of molecules with potential for pair and triple elastic collisions of particles. Gas properties with noticeable influence of triple collisions will differ from the usual properties due to the collision of the particles each other and with the solid surface. In accordance to Gibbs formalism considers not a single system, but the ensemble of them in 6-*N* dimensional *G*-space, with system's distributed according to the *N*-particle distribution function. Such an ensemble is described by the famous *Liouville* equation. The statistical independence of three particles before collision, solution of equation is $f_3(t, \tau_1, \tau_2, \tau_3)=f_1(t_0, \tau_{10})f_1(t_0, \tau_{20}) f_1(t_0, \tau_{30})$, $\tau_{a0} = \tau_{a0}(t, t_0, \tau_1, \tau_2, \tau_3)$ - coordinate and impulse values which particles at the moment t_0 for that at the time t get into given points τ_1, τ_2, τ_3 of the phase space. Now, let's move from f_1 to $f = Nf_1$, and find kinetic equation in the form of

$$\frac{\partial f}{\partial t} + \bar{\xi}\nabla f = St_2 f + St_3 f, \quad St_2 f(t,\tau_1) = \int \frac{\partial F_{12}}{m}\frac{\partial}{\partial \xi}\{S_{12} f(t,\tau_1) f(t,\tau_2)\}\, d\tau_2$$ - Integral for pair collisions

$$St_3 f(t,\tau_1) = \frac{1}{N}\int \frac{F_{12}}{m}\frac{\partial}{\partial \xi}\{R_{123} f(t,\tau_1) f(t,\tau_2) f(t,\tau_3)\}\, d\tau_2 d\tau_3$$ - Integral for triple collision

As processes for $R_{123} \neq 0$ which are including not only the triple collisions, but also combination of several pair of molecules [2].

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PARALLEL COMPUTING SYSTEM OF MONTE CARLO METHODS

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The parallelization of computations for the high-productive supercomputer systems appears to be one of the main ways of development of the modern computational mathematics. The supercomputers are the more and more widely used for a solution of the fundamental and applied problems in the areas of nuclear physics, climatology, economics, pharmacology, modeling of the training devices, and of the virtual reality, computational aerodynamics. Due to those specific features of the Monte Carlo methods, which were repeatedly stressed in the present paper, the statistical modeling begins to play the more and more noticeable role in all, indicated above areas of science and techniques. For these reasons, the actuality of the problems mentioned is growing very considerably, taking into account the fact that the computational aerodynamics is the most promoted area of the elaboration, development, and application of the Monte Carlo methods [1]. As the mentioned above features of these methods permit to state, that the numerical schemes of a statistical modeling might be, in quite a natural way, transferred onto the parallel processors. Clearly, the successive modeling of the independent trajectories should be entrusted to the individual processors, while the information for the averaging will be gathered by a server [2]. In this case, the productivity of the method is growing in direct proportionality to the number of parallel processors.

Nowadays, as computer processors become cheaper and more plentiful, there is great potential for having them compute together in a coordinated application. A major point of parallel computing is how to coordinate communication between the various processors; indeed, some parallel computing techniques require specialized programming to permit the processors to work together in parallel. It can be seen that on Monte Carlo simulations, algorithms proceed by averaging large numbers of computed values. It is sometimes straightforward to have different processors compute different values, and then use an appropriate average of these values to produce a final answer.

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THE MATHEMATICAL MODELING OF CHANGES DYNAMICS IN NUMERICAL INDICATORS TO DESCRIBE THE LEARNINGPROCESS

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The mathematical modeling, as one of their methods of the scientific knowledge and cognition is provided the opportunity to be explored the surrounding reality phenomena and the processes, by means of the symbolic expressions transformations, having displayed the significant interconnections and associations. So, the analogies establishment between the explored and the already studied objects, as one of the mathematical modeling methods, is allowed us to be studied the general system – wide laws and the regularities, having governed the quite inherent complex structural formations of the different nature [8]. The methodology development of the systems general theory under the modern information society conditions has already been led to the mathematical modeling using in the research – diversity of the didactic systems in the pedagogy.

The special model to be described the didactic systems functioning can be acted the differential equations. The example of the logistic parabolic equation use for the quality of the education modeling in the Institute of the Higher Education, the College, the University has been presented in the paper [9]. E.A. SolodovaandYu.P. Antonov, on the basis of the study results analysis of the mathematical model, have already revealed the main tendencies of the further improvement of the educational activity. So, the mastering quality development of the academic subject and the discipline [4] is one of the component of the quality of the education, so it is seemed appropriate to be studied its changes dynamics also the logistic parabolic equation to be applied.

Thus, the differential equation (DE), having called the logistic one, has been suggested in 1848 by the Belgian mathematician P.F. Verhulst (1804–1849) [7]. So, it has been allowed, for the first time, in modeling the special systemic factor, having limited the population growth. The population has been considered, as the opened developing system of the coverage in this presented model. Its number size change had been rushed to the certain limit, which was intended to be characterized the resources capacity of the habitable ecological niche. In this study, the fixed number mastering ofthe training elements (TE) [2] can be spoken the analogue of the growth restriction of the population quantity, within the framework of the program of some academic subject and the discipline. The set of the TE – this is the system of the theoretical knowledge and the practical skills, having formed in the learning process. So, the mathematical model, in this case, is as it is followed:

$$\frac{dn(t)}{dt} = kn(t)\left(1 - \frac{n(t)}{N}\right), \quad (1)$$

where:$dn(t)/dt$ – the rate of the mastering of the TE; k – the coefficient of the proportionality; $n(t)$ – the amount of the TE, which have been mastered by the students at the time moment t; $(1 – n(t)/N)$ – the relative magnitude of the mastering completion of the TE; N – the TE number, which are necessary to be mastered, in the framework of the program.

The Equation (1) is presented itself the DE with the multiple variables, so its general solution is by the integral calculus methods [3]. So, the particular solution for the initial condition,$n(0) = n_0$, will be taken the following expression:

$$n(t) = \frac{Nn_0 e^{kt}}{N - n_0 + n_0 e^{kt}}, \quad (2)$$

where n_0 – the number of the TE, which are necessary to be mastered at the previous stage of the learning, to be understood the theme material, the chapters, or the academic subjects, or the disciplines.

The functional dependence study (2) has been become quite possible, when the parameters values defining of the mathematical model (k, n_0, N). The coefficient k may be assigned, for example, the value of one, if the student performs the control and training activities for the standard time. If the execution time is quite more, than the normative one, then, in this case,k can be considered less, than one. If the execution time is quite less, than the normative one, then k should be taken more, than one. All these values of k are allowed to be distinguished three groups of the students. Thus, the First group