Vasiliy Ryazanov (Institute for Nuclear Research, Kiev, Ukraine,)

Influence of probability density function of the passage time in the method of non-equilibrium statistical operator on non-equilibrium properties of the system

A family of non-equilibrium statistical operators (NSO) is introduced which differ by the system lifetime distribution over which the quasiequilibrium (relevant) distribution is averaged. This changes the form of the source in the Liouville equation, as well as the expressions for the kinetic coefficients, average fluxes, and kinetic equations obtained with use of NSO. It is possible to choose a class of lifetime distributions for which thermodynamic limiting transition and to tend to infinity of average lifetime of system is reduced to the result received at exponential distribution for lifetime, used by Zubarev. However there is also other extensive class of realistic distributions of lifetime of system for which and after to approach to infinity of average lifetime of system non-equilibrium properties essentially change. For some distributions the effect of "finite memory" when only the limited interval of the past influence on behaviour of system is observed. It is shown, how it is possible to spend specification the description of effects of memory within the limits of NSO method, more detailed account of influence on evolution of system of quickly varying variables through the specified and expanded form of density of function of distribution of lifetime. The account of character of history of the system, features of its behaviour in the past, can have substantial influence on non-equilibrium conduct of the system in a present moment time.

This is the said generalization of Kirkwood time-smoothing averaging. This operation introduces in the formalism the so-called Bogoliubov's method of quasi-averages [1, 2]. Bogoliubov's procedure involves a symmetry-breaking process, which is introduced in order to remove degeneracies connected with one or several groups of transformations in the description of the system.

It is supposed that the exponential multiplier in a method of the non-equilibrium statistical operator (Zubarev`s approach) can be considered how density of distribution of the past lifetime of the system, and can be replaced by any distribution [3-5]. For definition of this distribution the method of maximum entropy principle as in [6] is used. The received distribution is close to exponential. If to use other approach to the maximum entropy principle, as in [7], except exponential distributions it is possible to receive power distribution, log-normal distribution, distributions of other kind and transitions between them.

[1] Bogoliubov, N. N., in Studies in Statistical Mechanics I, pp.4-118, de Boer, J., and Uhlenbeck, G. E., Eds. (North Holland, Amsterdam, 1962).
[2] Bogoliubov Jr, N.N., A Method for Studying Model Hamiltonians (Pergamon, Oxford, 1972).
[9] Ryazanov V V 2001 *Fortschritte der Phusik/Progress of Physics* **49** 885
[10] Ryazanov V V 2007 *Low Temperature Physics* **33** 1049
[11] Ryazanov V V 2009 Cond-mat, arXiv:0902.1454
[6] Schönfeldt J-H, Jiminez N, Plastino A R, Plastino A, Casas M 2007 *Physica A* **374** 573
[7] Van der Straeten E and Beck C 2008 *Phys. Rev. E* **78** 051101