ABOUT APPLICATION TECHNIQUE OF THE METHOD OF AVERAGED CHARACTERISTICS TO RELATIVISTIC ELECTRONICS PROBLEMS

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The method of averaged characteristics is ⁺a logical continuation of ideas that were put in the basis of such methods, as the method of averaged kinetic equation, the method of averaged quasihydrodynamic equation, and the method for density of current [1-2]. It appears historically as a specific combination of two well-known in the mathematics methods (the method of characteristic and the method of averaging) and specific calculative technology back transformations. Therein, the theory of hierarchic oscillation and waves is used as a conceptual basis [1-2]. The method discussed is destined, predominantly, for asymptotic integration of differential equations with partial derivatives with multi-frequency (including, multi-harmonic) nonlinear right parts.

It should be mentioned that theory of the method of averaging characteristics has done first steps just now. Only one technological realization of its general idea has been constructed before [1-2]. We talk about the version, where the method of characteristic is used for constructing a nonlinear equation with partial derivatives for some higher hierarchic level. Relevant solutions of the initial problem (the zero hierarchic level) can be found after accomplishing a set of so called back transformations. On the other hand, as an experience showed, a few other versions of this method can be developed. The main purpose of this work is demonstration of such possibility. Two calculative versions of this kind are discussed here.

The main idea of the first of them is the following. The first stage of the calculative procedure is constructing the

characteristics (exact differential equations) of a given nonlinear equation with particular derivatives. The next stage (in contrast to the earlier known calculative version [1-2]) is constructing a symptotic solutions for the characteristics using the method of averaging. Then, solutions of the initial equation with partial derivatives can be found on the basis of these asymptotic solutions.

Essence of the second calculation scheme proposed consists in the following. We use the asymptotic solutions of the averaged characteristics as a basis for constructing the solutions for corresponding averaged equation with partial derivatives (the equation of higher hierarchy). Then, the specific calculative technology of back transformations is used for obtaining the solutions of the initial problem.

As analysis showed, all three calculative versions abovementioned are not competitors really. The point is that each of these versions has its most suitable sphere of application. Therein, specific mathematical features of the initial problem determine the choice of the version. Calculative peculiarities of application of the different versions have been studied by authors at the example of nonlinear theory of two-stream instability in relativistic high-current system. Relevant results of this analysis are (and will) set forth in other our works.

REFERENCE

1. Kulish V.V. Hierarchical methods. Vol.II. Undulative electrodynamic systems, Dordrecht/Boston/London: Kluwer Academic Publishers, 2002.
2. Kulish V.V., Lysenko A.V., Savchenko V.I. Two-Stream Free Electron Lasers: Physical and Project Analysis of the Multiharmonical Models. // International Journal of Infrared and Millimeter Waves. –2003.- Vol. 24, N 4, P. 501-524.