MATHEMATICAL MODELING OF THE NONLINEAR PROBLEM OF PARTICLE DYNAMICS IN ACCELERATORS BY A CONTINUOUS ANALOGUE OF NEWTON'S METHOD

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An algorithm of the continuous analogue of Newton's method (CANM) is proposed for solving the boundary value problems of beam dynamics in accelerators.

The following results of the numerical simulations of three problems for accelerators are given:

1) Computation of the turn-focusing transport systems at a rapid output of the beam from the accelerator;

2) Optimization for the long "invisible" straight sections (insertions) of the accelerator and coherent analysis of nonlinear aberrations in them;

3) Finding of periodic orbits in the accelerator taking into account actual distortions of the magnetic field.

The CANM method proposed in this paper to solve a first problem, allows one to choose in the best way the parameters of the elements of transportation and to arrange as well as to estimate the tolerances on these parameters.

The second problem deals with a study of nonlinear aberrations in quadrupole lenses of the "invisible" section of the accelerator and its matching by taking these nonlinearities into account.

When solving a third problem, results have been obtained for correction of the orbit of the accelerator for various radii R by using a system of coils with current, located in the straight sections of the accelerator, which create an additional radial component of the magnetic field.