DISPERSION AND BETATRON FUNCTIONS IN NONLINEAR LATTICE
- COMPUTATIONAL METHOD AND ITS RESULTS -

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Abstract

In accelerators and storage rings, nonlinear elements are needed to correct the defects of linear lattice. Particularly, sextupole magnets are requisite to compensate chromaticities, which originate from the momentum dependence of quadrupole focal length and the sextupole field generated in bending magnets.

We explain the computational method of dispersion and betatron functions in the lattice including any nonlinear element, and present the results applying the method to the lattice including sextupole elements of PF-storage ring.

The transformation of particle motion in linear element is given by a transfer matrix. The transformation in nonlinear element is nonlinear and can not be given by a matrix. However, the elegant method of transfer matrix for linear lattices is also applicable to nonlinear lattices by the following procedure; (I) we linearize a nonlinear element in the vicinity of initial guess value of dispersion function, and make the linearized transfer matrix of the element. (II) we obtain the periodic solution of the transfer matrix of lattice and correct the initial guess of dispersion function. Subsequently, we iterate the above procedure until the sufficient convergency is obtained. We finally obtain the betatron function by using the last matrix.

The computational results show that the dispersion and betatron functions are rather distorted by sextupole elements and the distortion is sensitive to the strengths and arrangement of sextupole magnets, and that momentum dependent tune leaves from the nominal tune for the large momentum deviation.