Joint DESY and University of Hamburg Accelerator Physics Seminar

Tuesday, 26-th, 2008

(16:00 in Room 459/30b)

Effects of Quad Fringe Fields and Magnetic Interference

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Abstract

During the commissioning of the BEPCII storage rings [1], a large difference between the design and measured working points was observed. For one of the synchrotron radiation modes, when the nominal working point was set to be (7.27, 5.37), the measured working point was (7.205, 5.281) with orbit correction. The source was traced to the fringe fields of magnets, and magnetic interference between quadrupoles and sextupoles.

First, linear effects of fringe fields of quadrupoles and bending magnets were investigated. A simple method based on the theory of linear magnet imperfections was used to estimate the tune shift due to quad fringe fields. To get full understanding of quad fringe field effect, J. Irwin and C.X. Wang's method [2] based on Lie technique was revisited and applied to analyze the problem. Second, the magnetic interference between quadrupoles and sextupoles was simulated using OPERA-3D/TOSCA [3]. The simulation results showed that magnetic interference lead to a decay of about 0.6% on the integrated field strength of the quadrupoles. The sum of tune shift due to fringe fields and magnetic interference agrees with simulations using SAD [4].

As a next step, an equivalent hard edge model was derived based on the linear fringe maps. The model parameters were expressed explicitly by a series of fringe field integrals. The validity of the model was tested by comparing with numerical calculations. To improve the traditional hard edge model, a simple new hard edge model was proposed.

[1] J.Q. Wang, et al., The BEPCII: Status and Early Commissioning, PAC07

[2] J. Irwin and C.X. Wang, Explicit soft fringe maps of a quadrupole, PAC95

[3] `http://www.vectorfields.com/`

[4] `http://acc-physics.kek.jp/SAD/sad.html`

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