PROTON STORAGE RING OPTICS MODELING WITH AC-DRIVEN BETATRON MOTION

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Abstract

Unlike an electron storage ring with radiation damping, resonance excitation is unsuitable to a proton storage ring for turn-by-turn betatron orbit data. However, one may consider modified betatron motion driven by ac dipoles oscillating at frequencies near the betatron tunes. With a matrix formulation for adding ac-dipole effects on 2-D coupled one-turn map, we concatenate the ac-dipole effects and the one-turn map to obtain a modified linear map. The ac-dipole effects are equivalent to inserted symplectic linear maps at the ac-dipole locations. If the maps are normalized through decoupling similarity transformation, the decoupled maps for the ac-dipole effects are equivalent to 1-D thin quads inserted at the corresponding locations, the same conclusion for the 1-D driven oscillation*. For optics modeling with MIA technique**, one must make sure that there are, simultaneously, two transverse ac-dipole driven betatron oscillations along with one longitudinal synchrotron oscillation. Once the optics model for the modified betatron motion is obtained, one can then obtain the proton storage ring model by de-concatenating the inserted ac-dipole linear maps.

* R. Miyamoto, S.E. Kopp, A. Jansson, and M.J. Syphers, PRSTAB 11, 084002 (2008).

** Y.T. Yan, ICFA Beam Dynamics Newsletter, No. 42, pp. 71-87 (2007), Y. Cai, W. Chou, Eds.

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