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A novel method to suppress the emittance variation in extremely low emittance light source storage rings

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We propose a novel method to suppress the emittance variation caused by the opening and closing of the gap of insertion devices (IDs) in extremely low emittance light source storage rings. The core idea is to leak a small amount of dispersion into the straight section where IDs are installed and optimize its value so that the radiation excitation and damping caused by IDs are balanced [1]. A typical value of the leaked dispersion is about 10mm or less, and the storage ring can be considered quasi-achromatic. To carry out the optimization, we introduced a concept of “average ID peak field” over the ring as an indicator of the ID operating condition in user time. This concept allows us to represent a complex ID gap status with a single parameter and is very effective in deriving an equation for determining the optimum value of the leaked dispersion. The proposed method is passive and applicable to any light source storage ring, and the emittance variation is potentially expected to be less than 1% by carefully optimizing dispersion leakage. In this work we show how this scheme works for suppressing the emittance variation using the SPring-8-II storage ring [2] as an example.

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Footnotes

- [1] T.Hiraiwa, K.Soutome and H.Tanaka, Phys. Rev. Accel. Beams 25, 040703 (2022).
- [2] K.Soutome, T.Hiraiwa and H.Tanaka, in Proc. IPAC2022, Bangkok, p.477.

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