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Calculation of the CSR Effect on EEHG Performance

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Externally seeded FELs can produce fully coherent short-wavelength pulses with the advantage of higher shot-to-shot stability and spectral intensity than SASE radiation. For the FLASH2020+ project, the Echo-Enabled Harmonic Generation (EEHG) seeding technique achieves seeded FEL radiation in the XUV and soft X-ray range down to wavelengths of 4 nm. The implementation of the EEHG requires precise phase space manipulations in the seeding section of the beamline, which would make the performance of the EEHG sensitive to the collective effects, such as Coherent Synchrotron Radiation (CSR) in some working range. Therefore, it is essential to consider the CSR in EEHG simulations and to understand its impact on the electron beam properties. In this work, we compare different methods for calculating CSR and investigate the mechanism of its effect on the EEHG performance.

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