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Averaged FEL algorithm to simulate an arbitrary FEL polarization

Monday 2 June 2025 16:00 (2 hours)

FEL simulation codes are essential tools for simulating various FEL scenarios. Among the algorithms, the orbit-averaged algorithm is the most widely used due to its speed and low computational cost. The averaged algorithm simplifies physics model, so present codes such as GENESIS and SIMPLEX have limitations to model accurate features like FEL polarization and variations in electron beam current. Such details are possible when using an unaveraged algorithm (like PUFFIN). In this presentation we introduce an approach based on the averaged algorithm to simulate arbitrary FEL polarization and non-fixed electron beam current. Our method involves initializing all particles at the beginning of the simulation and performing particle calculations at each simulation step to account for the non-fixed electron beam. Additionally, arbitrary FEL polarization is calculated by modifying the FEL equations using the elliptical undulator formula and the GENESIS algorithm. Finally some demonstration will be shown comparing the performance of PAL-XFEL and results from other simulation codes to highlight the capabilities of this approach.

Footnotes

Paper preparation format

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