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A computational method for the beam-beam kick with six-dimensional coupled motion

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The beam-beam kick from a Gaussian beam with four-dimensional coupled motion was studied by Leunissen et al. In this work, we generalize their formulation to a Gaussian beam with six-dimensional coupled motion. In our proposed formulation, evaluating the beam-beam kick for each particle-slice interaction pair requires numerically solving numerous eigenvalue decompositions; hence, it can be computationally infeasible to be applied in the weak-strong simulation, where kicks for more than millions of particle-slice pairs must be calculated. To mitigate this problem, we approximate the parametric eigenvalue problem using Taylor expansion so that the eigenvalue decomposition for a given parameter can be easily calculated with its Taylor series. The numerical algorithm and the result will be discussed.

Footnotes

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