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GPU-Accelerated Study of Longitudinal Single-Bunch Instability in Electron Storage Rings

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Longitudinal single-bunch instability caused by high-frequency impedance poses a major challenge for achieving optimal performance in fourth-generation synchrotron light sources and future electron-positron colliders. Accurate simulations of this instability are critical but computationally intensive, requiring millions of macro-particles and dense slicing to resolve bunch density distributions. To address this, we present a GPU-accelerated tracking code that enables efficient longitudinal single-bunch instability simulations. Designed for high-performance GPUs on desktop computers, our approach provides an accessible, cost-effective alternative to computing clusters.

Footnotes

Paper preparation format

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