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GPU-accelerated simulation of longitudinal single-bunch instability in electron storage rings

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Longitudinal single-bunch instability driven by high-frequency impedance is 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, yet computationally intensive, often requiring millions of macro-particles and fine slicing to resolve bunch density distributions. To address this, we have developed a GPU-accelerated tracking code that enables efficient simulations of longitudinal single-bunch instability. Our solution is specifically designed to run on a desktop computer equipped with a high-performance GPU, providing an accessible and cost-effective alternative to computing clusters.

Footnotes

Funding Agency

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Yes

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