Contribution ID: **94** Contribution code: **TUP097** Type: **Poster Presentation**

The implementation of adaptive step size Runge Kutta integrator in Zgoubi

Tuesday 12 August 2025 16:00 (2 hours)

The Zgoubi simulation code for beam and spin dynamics employs a numerical method based on Taylor series to integrate the Lorentz and Thomas-BMT equations, optimizing computational efficiency while ensuring high accuracy and robust preservation of motion invariants. In this work, we developed and implemented an adaptive step-size Runge-Kutta (RK) integrator into Zgoubi to tackle growing computational demands in accelerator physics simulations. This new integrator complements Zgoubi's default solver, offering users the flexibility to choose between integration methods based on specific simulation requirements. We demonstrated that the adaptive step-size RK integrator achieves the necessary accuracy and performance for integrating the Lorentz and Thomas-BMT equations effectively.
A key advantage of Zgoubi lies in its wide optical elements library, featuring over 60 accelerator components and variants, which the new adaptive step-size RK integrator can seamlessly utilize. Developed and rigorously tested over decades across numerous projects, this library provides a high degree of confidence in the code' s reliability. The same advantage holds about ancillary computations such as synchrotron radiation, space charge, decay in flight, etc. The implementation of the adaptive step-size RK integrator supports Zgoubi's adaptability, enabling simulations of complex beam and spin dynamics with a trusted and well-established computational framework.

Please consider my poster for contributed oral presentation

Yes

Would you like to submit this poster in student poster session on Sunday (August 10th)

Yes

Footnotes

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Yes

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