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Fast spin tracking using a Magnus expansion

Tuesday 12 August 2025 16:00 (2 hours)

Spin motion in particle accelerators obeys the Thomas-Bargmann-Michel-Telegdi (T-BMT) equation. Due to the structure of the T-BMT equation, the spin-transfer quaternion of a magnet is generally a nonlinear function of the entrance coordinates even if the phase-space motion is linear. This nonlinear function can be written as a Dyson expansion, for example as employed in the program SPRINT, which normalized the first-order expansion of the spin-transfer quaternion. Alternatively, this nonlinear function can be written as a Magnus expansion. This paper points out that in cases where the phase-space coordinates change little, as is generally the case for accelerator elements, the Magnus expansion is a much more appropriate method to describe the nonlinear spin motion because this expansion terminates after the first term when the phase-space coordinates are constant. We will demonstrate, with several examples, that an approximation based on the Magnus expansion leads to very good agreement with time-consuming numerical integration, and to significantly better agreement than obtained with historical codes like SPRINT.

Please consider my poster for contributed oral presentation

Yes

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

No

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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