

Accelerator Physics and Technology Seminar

Understanding Sextupole: Part III - Large Amplitude Dynamics and Dynamic Aperture

Tim Zolkin, FNAL

Date: Tuesday, November 12

When: 4:00 pm CDT

Where: One West (WH1W) and Zoom

Abstract: This is the third in a series of three talks aimed at deepening our understanding of the dynamics induced by sextupole and octupole magnets in accelerator rings. The series is structured into three parts: (I) "Small Amplitude Dynamics and Nonlinear Detuning," (II) "Exact Analytical and Numerical Solutions," and (III) "Large Amplitude Dynamics and Dynamic Aperture."

In this concluding talk, we establish further connections between standard-form mappings and the symmetric McMillan map, utilizing the area-preserving Hénon map and accelerator lattices with thin sextupole magnets as representative case studies. Our findings reveal that, despite being a second-order approximation, the symmetric McMillan map accurately captures dynamics across a broad range of system parameters, showcasing its practical relevance in both theoretical and applied contexts. Specifically, it offers second-order analytical approximations for nonlinear betatron tune, nonlinear emittance, and dynamic aperture, along with exact expressions for twist (nonlinear detuning) and a qualitative explanation of their behaviors.

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