Contribution ID: **55** Type: **Invited talk**

Nonlinear beam dynamics tools for field treatment, symplectic tracking and spin in COSY INFINITY

Saturday, 5 October 2024 09:30 (30 minutes)

The DA methods employed in COSY allow for the computation of arbitrary order transfer maps. The derivation and antiderivation operations of the differential algebraic structure allow the construction of map integrators based on either Picard iteration or directional derivates that are significantly more efficient than conventional integrators. The tools also allow the automatic computation of fully Maxwellian 3D fields if only midplane or on-axis field information is available, which for example allows recovering all nonlinear effects arising from increasing or decreasing fields in the fringes of particle optical elements. They also allow the computation of such fields from surface or volume field measurements, leading to a fully Maxwellian representation even in the presence of noise in the data. Differential Algebra-based normal form methods allow the computation of nonlinear dynamics aspects for orbit motion as well for the computation of invariant spin axes and spin normal forms. Utilizing metrics on symplectic spaces, it is possible to construct minimally invasive symplectification schemes for tracking based on maps. Various examples of the performance of the methods are given, with particular emphasis on the high accuracy requirements of the spin and orbit dynamics of the FNAL muon g-2 ring.

Primary author: BERZ, Martin (Michigan State University)

Presenter: BERZ, Martin (Michigan State University)

Session Classification: Sessions in Living Room 1+2

Track Classification: F-1 Code Development, Status and Comparison with Measurements