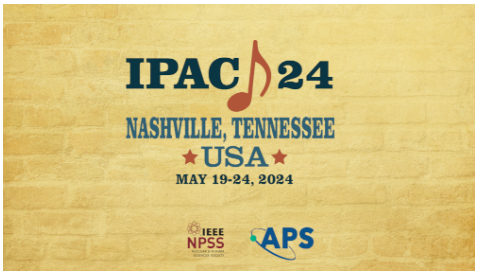

Contribution ID: **479** Contribution code: **THPC23** Type: **Poster Presentation**

Machine-assisted discovery of integrable symplectic mappings

Thursday, 23 May 2024 16:00 (2 hours)

Integrable systems possess a hidden symmetry associated with the existence of conserved quantities known as integrals of motion. These systems play an important role in understanding general dynamics in accelerators and have potential for future designs. This work will cover two automated methods for finding integrable symplectic maps of the plane.
The first algorithm is based on the observation that the evolution of an integrable system in phase space is confined to a lower-dimensional submanifold of a specific type. The second algorithm relies on an analysis of dynamical variables. Both methods rediscover some of the famous McMillan-Suris integrable mappings and ultra-discrete Painlevé equations.
Over 100 new integrable families are presented and analyzed, some of which are isolated in the space of parameters, while others are families with one parameter (or the ratio of parameters) being either continuous or discrete.
In addition, the newly discovered maps are related to a general 2D symplectic map through the use of discrete perturbation theory. A method is proposed for constructing smooth near-integrable dynamical systems based on mappings with polygon invariants.

Footnotes

Funding Agency

Paper preparation format

Region represented

North America

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Session Classification: Thursday Poster Session

Track Classification: MC5: Beam Dynamics and EM Fields: MC5.D01 Beam Optics Lattices, Correction Schemes, Transport