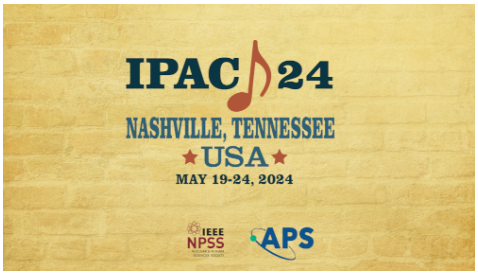

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Adjoint computation of lattice sensitivities using particle simulation codes

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

The design of accelerator lattices involves evaluating and optimizing Figures of Merit (FoMs) that characterize a beam's properties. These properties (hence the FoMs) depend on the many parameters that describe a lattice, including the strengths, locations, and possible misalignments of focusing elements. We have developed efficient algorithms to determine the multi-parameter dependence of an FoM, taking advantage of recent developments in adjoint techniques that facilitate the efficient computation of FoM derivatives with respect to the many parameters that describe a lattice. One algorithm applies to lattices and beams for which the paraxial approximation holds and particle motion is described as 4D in transverse phase space with distance along the beam path as the independent variable. Another algorithm—appropriate for implementation in a code such as OPAL—applies to beams in which particle trajectories are calculated in 6D phase space with time as the independent variable. We describe both the underlying adjoint theory and the numerical implementation of these algorithms.

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