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Rigorous bounds for the errors of high-order transfer maps

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High-order transfer maps offer many advantages in the study of both single-pass systems, where they represent optical aberrations, and multi-pass systems, where they allow the direct computation of relevant properties like high-order dispersions, chromaticities, and amplitude- and parameter dependent tune shifts. They also allow for symplectic tracking even for very complicated systems that cannot be described by inherently symplectic kicks and related methods. However, one remaining question is always how accurate a map of a given expansion order really is – while in many cases, the sizes of high order contributions decrease as a function of order, this does not always have to be the case, for example for the muon g-2 ring, strong nonlinearities newly arise at order 9 and beyond. In this talk, we present methods to determine mathematically rigorous bounds on all missing orders beyond the one explicitly considered. The computational effort to determine these bounds is small compared to the cost of the underlying high-order transfer map computation.

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