

ABSTRACT

Title of dissertation: ANALYTIC PROPERTIES AND CREMONA APPROXIMATION OF
TRANSFER MAPS FOR HAMILTONIAN SYSTEMS

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The motion of a dynamical system may be approximated as a sequence of discrete steps in time described by transfer maps. In the field of accelerator physics, Taylor series maps constitute a special, heavily-used class of such maps, which, despite their wide use, have poorly understood, or little appreciated, analytic properties. In Part I we show first how one may expect a (very general) transfer map to be analytic within some, perhaps quite limited, region of phase space. We then show that the underlying singularity structure of the original map--as determined by the dynamical system itself--governs the domain of convergence of a given Taylor series map. We conclude Part I by using the quartic anharmonic oscillator as an example to illustrate not only the complicated, rich, and very subtle behavior of such domains of convergence, but also the care and understanding required when drawing conclusions about the applicability of Taylor maps.

Following a Hamiltonian flow for a finite interval of time produces a symplectic map. In Part II we describe a procedure for converting a Taylor series approximation for a symplectic map into a polynomial map that is exactly symplectic--*i.e.*, a Cremona map--in such a way that the Cremona map agrees with the original Taylor map through terms of any desired order. We then introduce the concept of a sensitivity vector and show how that concept allows one to characterize optimal . . .

Figure 3: Sample abstract page for thesis / dissertation (Abell dissertation, partial)