

There are several remarks on the dynamics in SAD:

- All transformations in SAD are symplectic up to the round-off errors, except radiations.
- The Hamiltonian describes the motion of particles in the *body* of an element. Some effects at the boundary of an element, *field*, are not expressed by the Hamiltonian. SAD treats them by canonical transformations approximating these effects.
- In a case of a linac, where the design momentum p_0 changes along the beam line needs a special treatment.
- The Hamiltonian above analytical solutions in the case of constant field without acceleration, ie., in a solenoid + constant field, such analytic solutions.
- If the field is linear in x and y such as for QUAD, and there is no acceleration, the Hamiltonian truncated up to the third order in (x, p_x, y, p_y) has an analytic solution. SAD uses that solution and adds the nonlinear corrections coming from the element. This method gives the exact linear transformation at least around the design orbit.
- Transformations shown in this manual are not necessarily coded as they are. Considerations for round-off errors and efficiency are taken into account in actual routines.
- Transformations shown here are basically for trackings. EMITTANCE(EMIT) and CALC may use slightly different transformations depending on the element.