

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, has 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 higher order terms in 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.