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Finite Orbit Analysis of Energetic Particles In Tokamak Plasmas[1] S.C. CHIU, Sunrise R&D, V.S. CHAN, General Atomics — Energetic particles are commonly generated in tokamak plasmas, whether by NBI or RF, and in reactors, Alpha-particles are intrinsically present. For these particles, the orbit widths may not be small compared with the minor radius; in fact, for regions sufficiently close to the axis, one can argue that finite orbit effects are important for nearly all particles. In this work, the orbits of particles are analysed without the assumption that the orbit width is small, by using the adiabatic constants of motion. It is shown that the magnetic geometry leads to intrinsic asymmetry of co- and counter-current moving particles which has important effects on RF-induced rotation drive. It is proposed that a convenient approach in analysing finite orbits is to consider the particles as radial oscillators. Analytic expressions for orbit widths and orbit averaged quantities such as toroidal precession speed and radial locations are obtained. Special interest is placed on the discontinuity of the orbit topology near the trapped-passing boundary. Effect of Coulomb collision on angular momentum drive will be discussed.

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