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Electron Cyclotron Current Drive Efficiency in Finite Collisionality Regime

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Reduction of rf current drive efficiency by trapped electrons in tokamaks is a widely discussed subject in the literature. Nevertheless, most quantitative investigations of the effect invoked the bounce average approximation, which assumes that effective collision frequency is much smaller than bounce frequency for trapped electrons at all energies. The zero-collisionality assumption neglects the de-trapping process of electrons due to collision and underestimates current drive efficiency. Collisionality enhancement of current drive efficiency might be small in high temperature reactor-grade tokamak plasmas, but the situation is less clear for the present-day experiments, especially in the case of off axis electron cyclotron current drive (ECCD). In this work, we use Green's function formulation to calculate ECCD efficiency in the regime of finite collision frequency. The Coulomb collision operator is simplified by considering pitch-angle scattering only, *i.e.*, Lorentz gas model. The numerical problem involved is reduced to solving a two-dimensional finite difference equation. Collisionality corrections of ECCD efficiency are evaluated using DIII–D experimental parameters and impact on Advanced Tokamak (AT) operational scenarios will be discussed.

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