Full-wave modeling of ICRF waves: quasi-local and global descriptions

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Waves in the Ion Cyclotron Range of Frequencies (ICRF) undergo significant space dispersion as they propagate in magnetic fusion plasmas, making it necessary to incorporate non-local effects in their physical description. Full-wave codes are routinely employed to simulate ICRF heating experiments in tokamaks. The vast majority of these codes rely on a description of the plasma based on a "quasi-local" derivation of the dielectric tensor, i.e. assuming that the range of space dispersion remains small compared to the system dimensions. However, non-local effects caused by wide particle orbits are expected to play a significant role in current and future experiments featuring wave-driven fast ions, fusion-born alpha particles… Global formalisms have thus been proposed to include these effects in a more comprehensive fashion. Based on a description of the particle dynamics in terms of action-angle variables, a full-wave code, named EVE, is currently under development. In its first version, it incorporates quasi-local expressions, valid to second order in Larmor radius, derived from the more general Hamiltonian formalism. The obtained tool has the advantage of being compatible with the current requirements of integrated modeling, and lends itself to direct comparisons with existing codes. The formalism of EVE, as well as simulations of ICRF experiments will be presented. Since it is also designed as a tool aimed at testing quasi-local predictions versus simulations including further non-local effects, foreseen developments in this direction will be addressed.