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Iterative Methods to Solve Linear RF Fields in Hot Plasma[1]
JOSEPH SPENCER, VLADIMIR SVIDZINSKI, EVSTATI EVSTATIEV, SERGEI GALKIN, JIN-SOO KIM, FAR-TECH, Inc. — Most magnetic plasma confinement devices use radio frequency (RF) waves for current drive and/or heating. Numerical modeling of RF fields is an important part of performance analysis of such devices and a predictive tool aiding design and development of future devices. Prior attempts at this modeling have mostly used direct solvers to solve the formulated linear equations. Full wave modeling of RF fields in hot plasma with 3D nonuniformities is mostly prohibited, with memory demands of a direct solver placing a significant limitation on spatial resolution. Iterative methods can significantly increase spatial resolution. We explore the feasibility of using iterative methods in 3D full wave modeling. The linear wave equation is formulated using two approaches: for cold plasmas the local cold plasma dielectric tensor is used (resolving resonances by particle collisions), while for hot plasmas the conductivity kernel (which includes a nonlocal dielectric response) is calculated by integrating along test particle orbits. The wave equation is discretized using a finite difference approach. The initial guess is important in iterative methods, and we examine different initial guesses including the solution to the cold plasma wave equation.

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