First Order Corrections to the Plasma Conductivity for Wave Heating Simulations with AORSA*

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Spectral wave solvers such as AORSA [1] have been used to model electromagnetic wave heating in two dimensional (2D) tokamak plasmas. Spectral methods allow wave solutions to all orders in the ratio of ion Larmor radius to wavelength (ρ/λ). However, 2D simulations with AORSA have so far assumed a plasma conductivity that is zero order in the ratio of ion Larmor radius to equilibrium scale length (ρ/L). Here we extend these calculations to include first-order corrections proportional to gradients in density, temperature and magnetic field [2]. These corrections provide a generalization of odd-order derivative terms in finite difference schemes, and yield conservation equations to first order in ρ/L which can be important for conservation of energy. Results for Maxwellian plasmas show that these corrections are significant when mode-converted electrostatic waves propagate in regions of strong gradients.

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