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Fusion Antenna Analysis Using the Modular Oak Ridge RF Integration Code (MORRFIC)¹ MARK CARTER, Oak Ridge National Laboratory — Nonlinear and small scale effects occur in the RF near-fields of fusion antennas, including sheaths, ponderomotive effects, and gas build-up to self-generate plasma. Integrated modules in MORRFIC estimate the importance of, and the interplay between, these various effects. Modules include a linear RF Maxwell solver with azimuthally symmetric boundary conditions and plasma variations across and along field lines that can be used to estimate ponderomotive effects, sheath driving terms, and collisional dissipation. Other modules can be iterated with these solutions to study a weakly-ionized 2D model of collisional transport in RF self-generated plasma. A sheath mask is implemented to study different non-linear sheath models, and diagnostics are available to estimate non-linear effects. Models that resolve the sheath layer, with a time-averaged electron density inside the sheath, show strong absorption of RF power by confined electrons that sample the sheath. This absorption is influenced by the lower-hybrid and electron-plasma resonances and complicates the use of simplified sheath boundary conditions designed to relax the computational requirement to resolve the sheath. Imbalances in the RF voltage for sheaths connected along field lines are also found, pointing out the need for new theories to handle the DC rectification under these conditions.

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