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Propagation of radio frequency waves through spatially modulated interfaces in the plasma edge in tokamaks

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In tokamaks, radio frequency waves are used to control the temperature and the current in the plasma core. Before the waves reach their target in the core, they are being scattered by density fluctuations that exist in the plasma edge, known as blobs [1,2] or turbulent interfaces. The propagation of RF beams through interfaces are studied numerically using the finite difference frequency domain method (FDFD) in conjunction with the Total-Field Scattered Field (TFSF) method and the Perfect Matching Layer (PML) absorbing boundary condition [3]. For that purpose, the interfaces are considered to have a harmonically spatially modulated shape and the incident beam is approximated by a plane wave of wavelength comparable to the interface modulation period. Results will be compared to the COMSOL commercial numerical solver and the semi-analytical Rigorous Coupled Wave Analysis (RCWA) [4] solver for anisotropic media that is under development. The frequency range of the RF waves studied is the electron cyclotron and lower hybrid frequency range for ITER-like and Medium Size Tokamak applications (such as TCV, ASDEX-U, DIII-D, etc). The study covers for a variety of density contrasts between across the interfaces and a wide range of interface modulations.

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References

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