TWO-DIMENSIONAL FULL-WAVE SIMULATION OF PROPAGATION AND ABSORPTION OF A MICROWAVE BEAM IN MAGNETIZED PLASMA

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A two-dimensional full-wave numerical code to calculate propagation of an extraordinary polarized microwave beam across the magnetic field in a nonuniform plasma is developed. The interaction of the microwave field with plasma near the resonance at the second harmonic of the electron gyrofrequency is described using the operator expression for the weakly relativistic thermal correction to the plasma permittivity tensor [1],

 , (1)

where

 , (2)

, , ,  is the Dnestrovskii function, , and  is the nonrelativistic electron gyrofrequency.

Results from solving a model two-dimensional problem on the propagation and absorption of a microwave beam in plasma for the magnetic configuration of the L-2M stellarator are presented. The coefficients of absorption and reflection are calculated. The distributions of the microwave power absorbed in plasma are obtained. It is found that, under conditions typical of L2-M experiments on ECR plasma heating at the second harmonic of the electron gyrofrequency, an appreciable fraction (about 10%) of the incident microwave power can be deflected downward from the plasma axis, not reaching the absorption region. The fraction of the downward-deflected microwave power is shown to increase considerably at central plasma densities close to the cutoff density (*ne* ≈ (0.8−0.9)*n*cut). The simulation results are compared with results of calculations by the ray-tracing method.

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References

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