NUMERICAL SIMULATION OF CURRENT DRIVE USING INTERMEIATE FREQUENCY RANGE WAVES IN A TOKAMAK [*)]

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This paper presents an updated numerical code FRTC-2, created on the basis of the numerical code FRTC [1, 2] developed at the Ioffe Institute, incorporated into the numerical code ASTRA [3]. The numerical code FRTC-2 was created to solve the problem of propagation of electromagnetic waves of the intermediate frequency range in the tokamak plasma and to calculate the magnitude and profile of the generated current.

The numerical code FRTC-2 consists of three main parts. In the first part, the spectrum of the antenna starting decelerations calculated by the GRILL3D code [4], plasma parameters calculated by the EFIT code [5] and plasma equilibrium calculated for a specific time by the ASTRA code are read. In the second part, the radial trajectories of electromagnetic waves in plasma, the absorbed power and the diffusion coefficient are calculated. In the third part, the dynamic one-dimensional Fokker-Planck equation is solved taking into account the diffusion coefficient calculated in the second part. The magnitude and profile of the driven current is transmitted to the ASTRA code to calculate the equilibrium at the next moment in time. Calculations take into account the evolution of plasma parameters over time.

The FRTC-2 numerical code provides the possibility of calculations with both one-dimensional and two-dimensional spectrum of antenna starting decelerations, calculations are carried out taking into account gradient terms that take into account the curvature of magnetic field lines, thermal corrections to the plasma permittivity tensor are added. The code calculates the propagation of low-hybrid waves and helicons in tokamak plasma. The interface and shell "ASTRA-Box" for the system of codes FRTC-2 and ASTRA is developed in Python and allows to conveniently start the calculation process, organize input and output files, quickly visualize the results of calculations.

Examples of calculations for Globus-M2, FT-2 and T-15MD tokamaks are shown.

References

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