OLGA – an efficient full wave code for coupling of lower hybrid grills

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Lower hybrid (LH) waves are very important for heating and current drive in tokamaks. Phased arrays of rectangular waveguides, generally called grills, are typically used as launchers. We have developed a full wave code OLGA [1] which solves, in the 3D geometry of the grill structure, the problem of the coupling efficiency, namely the power density spectrum of the emitted waves, the power reflection coefficient, the power lost by the waves launched in the inaccessible region and the directivity of the waves transmitted to the accessible region. An efficient adaptive full wave solver is used to determine the wave propagation in 1D plasma slab geometry. We adopted an iterative evaluation of the integrands in the inaccessible region to handle their near to singular behaviour and the spectral power density caused by eigenmodes.

We have implemented the scattering matrix formalism for determining the coupling of multi-row, multi-junction, active-passive structures (such as the C3 and C4 launchers on TORE SUPRA) [2]. The extended code is still computationally fast by the use of 2D splines of the plasma surface admittance in the accessibility region of the k – space, by the use of high order Gaussian quadrature rules for the integration of the coupling elements and by the application of the symmetry rules of the coupling elements for the multi-periodic structures. We successfully benchmark the coupling of the C3 and C4 launchers as determined OLGA with the ALOHA-1D, ALOHA-2D and TOPLHA results for a TORE SUPRA discharge. We calculate the 3D electric field in front of the grill and estimate the effects of the plasma slab eigenmodes.

References

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