FULLWAVE CODE FOR SIMULATION OF COAXIAL CAVITY GYROTRONS

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Coaxial cavity gyrotrons with a corrugated insert presently are under engineering design for ITER applications. The corrugated insert plays an important role in a highly overmoded coaxial gyrotron cavity making problems of mode selection and beam voltage depression less serious. Therefore, these devices are expected to be capable to reach an output power of more than 2 MW in CW regime, what is far beyond of capabilities of present-day conventional cavity gyrotrons. The achievement of the record for this type of gyrotron output power (2.2 MW at 165 GHz) by the Forschungszentrum Karlsruhe (FZK) gyrotron group was reported [1]. It should be pointed out, that escalation of the power level of coaxial gyrotrons is rigidly connected with increasing the azimuthal and radial numbers of the operating mode. However, successful design and optimization of such highly overmoded "super power" tubes can be significantly facilitated on the basis of rigorous and reliable modelling considerations.

So far, the theory of coaxial cavity gyrotrons was based on the simplified surface impedance model (SIM) of the corrugated inner conductor (see, for example, [2] and references therein) which has a limited range of applicability and can hardly be feasible for present and forthcoming prototypes of coaxial cavity gyrotrons. New code is now under development in Kharkiv National University. It incorporates nonlinear slow-time multi-mode theory for description of beam-wave coupling with full wave calculations of RF field inside the coaxial gyrotron cavity [3] which takes into account all spatial harmonics appearing due to corrugated insert. The results of new improved consideration for the ITER relevant 2 MW 170 GHz coaxial gyrotron which is now under development in FZK will be presented. Recommendations for optimization of the coaxial gyrotron cavity are planned to elaborate in order to achieve higher efficiency and output power.

References

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