1D description of transport in TOMAS ECRH plasma

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The TOMAS (TOroidal MAgnetized System) device, operated at FZ-Jülich, Germany, has recently received an upgrade and is taken into operation to study wall conditioning, plasma production and plasma-surface interaction in tokamaks and stellarators. The original Electron Cyclotron Heating system has been upgraded with a new mid-plane launcher to produce currentless discharges by resonant or collisional absorption of RF power. The installation of single- and triple-pin Langmuir probes allows the study of the radial plasma profiles in ECRH plasmas.

The 1D transport oriented model for magnetized toroidal RF discharges, TOMATOR-1D, is developed to provide information on the power absorption and transport mechanisms in these toroidal magnetized plasmas. The standard continuity and heat balance equations given by Braginskii are adopted in cylindrical slab geometry to describe numerically the evolution of ECRF plasma parameters in tokamaks. Both the diffusion coefficient $D(r,t)$ and the convection velocity $V(r,t)$ are implemented such that they can depend on the radial coordinate. The code has been benchmarked against data from helium ECRF plasmas on TCV.

The radial plasma profiles produced in TOMAS can be measured in various conditions using the single- and triple-pin Langmuir probes. The TOMATOR-1D code reproduces these measured radial density profiles to gain insight in the efficiency of resonant or collisional absorption of RF power. Also the dependencies of the transport coefficients can be studied.

Predicting the RF plasma parameters for future large devices such as JT-60SA and ITER requires a good understanding of the power absorption and transport mechanisms of the toroidal magnetised plasmas. The TOMAS device and the TOMATOR-1D code can make a valuable contribution to this end.

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