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Integrated Modelling of DEMO-FNS Current Ramp-up Scenario and Steady State Regime

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The approach to the integrated modelling of plasma regimes in the projected neutron source DEMO-FNS [1] based on different codes is developed. The integrated modelling allows eliminating uncertainties in external parameters for such tasks as plasma current ramp up, steady-state plasma consistency, plasma stability and heat load onto the wall and divertor plates. The following codes are employed for the integrated modelling
1. The ASTRA transport code [2] is used for adjustment of the steady-state regime parameters. The NUBEAM Monte Carlo code incorporated into the ASTRA code
2. The DINA free boundary equilibrium and evolution code [3]
3. The SPIDER free boundary equilibrium and equilibrium reconstruction code [4] and KINX ideal MHD stability code [5
4. The TOKAMEQ free boundary equilibrium code [6] and the TOKSTAB vertical displacement stability code [7].
5. The SOL-Onion-skin semi-analytic modelling code of self-consistent description of the core, edge and divertor plasmas based on the experimental scaling laws [8]. The uncertain parameters are verified by calculations of the main plasma profiles with the ASTRA code and of the edge and divertor plasma with the B2SOLPS5.2 [9] code.
The consistent steady state regime for the DEMO-FNS plasma and the plasma current ramp up scenario are developed as a result of integrated modelling approach. The design with the long-legged divertor is proposed. The copper insets are suggested for the suppression of the instability to vertical displacement.

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