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Predictions of toroidal rotation and torque sources arising in non-axisymmetric perturbed magnetic fields in tokamaks

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Capabilities of the integrated framework consisting of TOPICS, OFMC, VMEC and FORTEC-3D, have been extended to calculate toroidal rotation in fully non-axisymmetric perturbed magnetic fields, for demonstrating operation scenarios in actual tokamak geometry and conditions. It was found for the first time that the toroidally localized perturbed fields due to the test blanket modules (TBMs) and the heating and diagnostic ports in ITER augment the neoclassical toroidal viscosity (NTV) significantly, while do not influence confinement of beam ions and alpha particles. The NTV takes up a large portion of total torque in ITER and fairly decelerates toroidal rotation. It was found that varying the numerical coefficient added to the intrinsic torque model by the residual stress within a factor of unity improves the reproducibility of toroidal rotation in JT-60U H-mode plasmas. This fact opens up access to reliable rotation predictions in H-mode plasmas.

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