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Development of the NLT code for gyrokinetic simulations of turbulence transport

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We report the advances in the development of the gyrokinetic turbulence code NLT [1], which is a 5D electrostatic semi-Lagrangian code based on the I-transform theoretical model [2-5]. The filed-aligned coordinates has recently been implemented in the code instead of magnetic flux coordinates to improve computational efficiency for numerical simulations of tokamak turbulence and transport. The 4D B-spline interpolation in field-aligned coordinates is applied to solve the gyrokinetic Vlasov equation. A fast iterative algorithm is proposed for efficiently solving the quasi-neutrality equation, which keeps the complete form of polarization density in the long wavelength limit. A pseudo transform method is used for numerical integration of the gyro-average operator. Some numerical tests are presented to illustrate the new methods. Numerical test show that NLT has a better computational efficiency compared to traditional semi-Lagrangian code which is usually based on the time splitting method [6].

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