Global Simulation of Linear ITG Instabilities in W7-X and LHD with EUTERPE

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The global (full radius, full flux surface) gyro-kinetic particle-in-cell (PIC) code EUTERPE is used as an efficient tool for numerical simulation of plasmas in three-dimensional (3D) magnetic fields. EUTERPE is capable of simulating up to three kinetic species - ions, electrons and fast particles/impurities. The code solves the field equations for the electrostatic and parallel vector potentials and can be used for linear and nonlinear simulations. Recent developments also included collisions and a coupling to the reduced MHD code CKA to study energy transfer between fast particles and MHD modes. EUTERPE is routinely applied to 3D equilibria obtained with the VMEC equilibrium code.

With respect to the upcoming operation phase of the Wendelstein 7-X stellarator, it is of particular interest to establish EUTERPE as a reliable modelling tool which can help to explore the impact of different parameters on possible plasma instabilities.

We will present systematic results for the simulation of electrostatic ITG instabilities based on finite-$\beta$ equilibrium data for Wendelstein 7-X (W7-X) as well as for the Large Helical Device (LHD). The main focus will rest on the linear growth rates in both devices as derived from a detailed power transfer analysis, supplemented by other diagnostic tools available with the EUTERPE code.