Gyrokinetic simulations of electrostatic microinstabilities and turbulence with bounce-averaged kinetic electrons for shaped tokamak plasmas

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Nonlinear bounce-averaged kinetic theory is extended to shaped tokamak plasma equilibria and applied in gyrokinetic code gKPSP to achieve efficient ITG-TEM simulations. With this bounce-averaged gyrokinetic simulation tool, we have obtained the following main conclusions.

1) Stabilizing effects of elongation on both ITG and TEM can be understood in terms of magnetic flux expansion leading to the effective temperature gradient $R/L_T(1-E')$ and poloidal wave length contraction at low field side resulting in the effective poloidal wave number $k_\theta \rho_i/\kappa$.

2) collisional effects on TEM depend on parameters of density gradient and electron temperature gradient. Density driven TEM can still be unstable at high collisionalities.

3) plasma elongation can stabilize both electron and ion heat conductivity in TEM dominant turbulence transport.

For the future work, investigation of saturation mechanism of TEM dominant turbulence is planned, especially to understand the stabilizing effect of elongation on ITG-TEM driven turbulence, such as the enhancement of residual zonal flow, etc. The characters of TEM-driven turbulent transport in low collisionality regime will be also studied in future.