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Verification of kinetic/MHD hybrid simulation of neoclassical tearing mode in fusion plasmas KAIJIE WANG, CHIJIE XIAO, Peking University, WENLU ZHANG, Chinese Academy of Sciences, ZHIHONG LIN, University of California, Irvine, XIAOQUAN JI, Southwestern Institute of Physics — Simulations and predictions of the excitation threshold of neoclassical tearing mode (NTM) are challenges, since the excitation threshold depends on large-scale MHD instabilities, collisional transport, microturbulence, and energetic particle effects, etc. A hybrid simulation of NTM with gyrokinetic ions and fluid electrons has been developed and verified in the gyrokinetic toroidal code (GTC) to study this problem. An extra pressure transport equation is included to cover the pressure fattening effect. The bootstrap current is included with a simple model, $\mathrm{j_{bs}} = -1.46\frac{\sqrt{\epsilon}}{\mathrm{B}_\theta}\frac{\partial \mathrm{p}}{\partial \mathrm{r}}$. In the fluid limit, it is verified that the linear growth rate of NTM is proportional to the poloidal beta β_p when the equilibrium profiles are fixed, and the linear and nonlinear simulation results of NTM are compared with theory and quantitatively agree with the modified Rutherford equation. The kinetic effects of thermal ions are found to reduce the linear growth rates of NTM and the finite Larmor radius effects of thermal ions have little impacts on NTM.

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