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M3D-K Simulations of High Frequency Fishbone Instability in Tokamak Plasmas

J.X.Yang[1], G.Y.Fu[2], Wei Shen[3], Minyou Ye[1]

[1] Department of Engineering and Applied Physics,School of Physical Science,University of Science and Technology of China,Hefei 230026 China, [2] Institute for Fusion Theory and Simulation and Department of Physics,Zhejiang University,Hangzhou 310027,China, [3] Institute of Plasma Physics,Chinese Academy of Science,Hefei 230021,China

e-mail :yangjx@mail.ustc.edu.cn

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Linear and nonlinear simulations of High Frequency fishbone instability driven by energetic circulating particles in tokamak plasmas were carried out using the kinetic/magnetohydrodynamic (MHD) hybrid code M3D-K. Linear results show that the mode structure is localized near the magnetic axis and is much narrower than that of the MHD internal kink mode. In contrast, the radial structure of the fishbone mode driven by trapped particles is similar to that of the internal kink mode. Simulation results also show that the high frequency fishbone instability turns into TAE instability as the β ratio of EPs increases. The transition between fishbone mode and TAE mode also occurs When the instability driven by passing particles evolves into the nonlinear phase. Detailed results will be presented.