TH/P2-07 · The Instability Criterion for Ideal and Resistive MHD Modes

Ding Li, University of Science and Technology of China, Hefei, China
Contact: dli@ustc.edu.cn

Abstract: The instability criterions for ideal helical perturbation and resistive kink/tearing modes are derived for arbitrary q profile. It is found that the q=1 mode can be unstable only within the q=1 surface in positive shear plasma. The instability region is enlarged as q_0 decreases and/or the current density is flatted. The instability can be completely suppressed in the reverse shear plasma for peaked, and flatted current profile. The q>1 modes are stable in the plasma core and marginal stable within the rational surface in the positive shear plasma. They become more stable in the plasma core and still marginal stable around the rational surface in the reversed shear plasma. It is shown that in the positive shear plasma, the q=1, 5/4, 4/3, 3/2 and 2/1 modes are in turn destabilized and becomes dominant unstable mode as q_0 increases for fixed q_a. In the reversed shear plasma, all the q=1 and q>1 modes can be stable when q0<1. The q=1 and q>1 modes in turn becomes unstable as $q_0(>1)$ increases. At first, the inner branch is stable while the outer branch weakly unstable. Then, the both branches can become strongly unstable as q0 increases.

TH/P2-08 · Two-Fluid and Nonlinear Effects of Tearing and Pressure-Driven Resistive Modes in Reversed Field Pinches

V. V. Mirnov, University of Wisconsin, Madison, USA
Contact: vvmirnov@facstaff.wisc.edu

Abstract: Large-scale tearing instabilities have long been considered to underlie transport and dynamo processes in the reversed field pinch (RFP). The vast majority of theoretical and computational RFP work has focused on pressureless, single-fluid MHD in cylindrical plasmas driven solely by a toroidal electric field. We report results of five investigations covering two-fluid dynamos, toroidal nonlinear MHD computation, nonlinear computation of Oscillating Field Current Drive (OFCD), the effect of shear flow on tearing instability, and the effect of pressure on resistive instability. The key findings are: (1) two-fluid dynamo arising from the Hall term is much larger than the standard MHD dynamo present in a single-fluid treatment, (2) geometric coupling from toroidicity precludes the occurrence of laminar single helicity states, except for nonreversed plasmas, (3)OFCD, a form of AC helicity injection, can sustain the RFP plasma current, although magnetic fluctuations are enhanced, (4) edge shear flow can destabilize the edge resonant m = 0 modes, which occur as spikes in experiment, and (5) pressure driven modes are resistive at low beta, only becoming ideal at extremely high beta.

TH/P2-09 · Kelvin-Helmholtz Instability and Kinetic Internal Kink Modes in Tokamaks

H. Naitou, Faculty of Engineering, Yamaguchi University, Ube, Japan
Contact: naitou@plasma.eee.yamaguchi-u.ac.jp

Abstract: The m=1 and n=1 kinetic internal kink (KIK) mode with a nonuniform density profile is studied by the cylindrical version of the gyro-reduced-MHD code which is one of the extended MHD codes being able to treat the physics beyond resistive MHD. Electron inertia and electron finite temperature effects are crucial. The linear mode structure of KIK mode includes the sheared poloidal flow with m=1, which excites the vortexes due to the Kelvin-Helmholtz (K-H) instability. We have found that there is a strong coupling between the KIK mode and the K-H mode even in the early nonlinear stage of KIK instability in which the width of the m=1 magnetic island is sufficiently small.