MHD Instabilities in Current Carrying Heliotron Plasmas

Goshi YAMADA et al. Plasma Fusion Res. 5, 021

Instabilities in low beta \( l = 2 \) heliotron plasmas with peaked toroidal current density profiles are investigated using resistive reduced magnetohydrodynamic equations. Such heliotron plasmas can have a nonmonotonic rotational transform \( \tau \) profile with two \( \tau = 2/3 \) rational surfaces. When the distance between the resonant surfaces is large, resistive instabilities can be found. Current-driven ideal modes with larger growth rates appear when the minimum of the rotational transform becomes just above the rational number \( 2/3 \) and there is no resonant surface. The existence of this nonresonant mode is explained by the expression for the current-driven term of the plasma potential energy.

Change of Resonant Electron Orbits from Trapped to Passing in Fast Wave Current Drive

Kun YAO and Yanping ZHAO Plasma Fusion Res. 5, 025

In fast wave current drive, fast waves accelerate resonant electrons in the direction parallel to the static magnetic field, causing parallel velocity to increase. The trajectory of a trapped resonant electron is calculated by computer code in which fast wave induced diffusion in velocity space is accounted for by a quasi-linear operator. Simulations show that the orbit of a trapped resonant electron transits from trapped to passing in some cases, reducing the effect of trapped electrons on current drive and improving current-drive efficiency. We determined the conditions under which this type of transition occurs.