Stability analysis of the core equilibrium (q<1) perturbed by current blip by ECH/CD in KSTAR plasmas

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Multiple mode structures (m/n=2/3, 3/4, etc.) in the core of the sawtoothing plasma (q<1) under the electron cyclotron heating / current drive (ECH/CD) have been observed by the KSTAR 2D/3D ECEI system. A systematic scan of the ECH/CD along the vertical direction provides an opportunity to perturb the current density profile from the center to q~1 surface. As the current perturbation position is changed from the center to q~1 surface, the poloidal mode number of the measured mode structure has been increased from m=2 to m=4 or more after the crash of each sawtooth. Toward the end of the sawtooth period, all higher m modes transform into the m/n=1/1 mode which forms precursor oscillation and then crashes. In order to understand the observed multiple mode structures and background equilibrium, the linear stability of the core equilibrium with the modified current density profile has been investigated using the reduced MHD equations in cylindrical geometry. A radial safety factor profile with q₀ <1 resulting in a normal m/n = 1/1 internal kink has been assumed, and then the position of a small current blip by ECCD has been varied from the center to q~1 surface similar to the experimental arrangement. In addition, the central safety factor q₀ has been changed from ~0.7 to slightly above ~1.0 and investigated the growth rate of each modes. The preliminary results suggest that the observed multiple mode structures are consistent with the evolution of the equilibrium q profile and the position of the perturbed current density blip.

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