Subject: 6) Dynamic stabilisation and parametric resonances in dynamic magnetic fields

Modelling of the stability and the growth of the magnetic islands induced by the Dynamic Ergodic Divertor

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The dynamic ergodic divertor (DED) experiment has been started on TEXTOR tokamak [1]. The DED can apply not only static but also rotating magnetic perturbation fields with a frequency up to 10 kHz. The penetration process of the DED magnetic perturbation fields into tokamak plasmas in quasi-steady state has been already investigated [2], where the torque transfer from the DED to the tokamak plasma and the magnetic island formations around the resonance surface are discussed.

In this paper, the penetration process of the static and rotating DED magnetic perturbation fields into tokamak plasmas has been investigated by simulations based on the reduced set of resistive and viscous MHD equations in the cylindrical geometry. In the present time-dependent and one-dimensional problem, the differential equations were numerically solved by PDE2D code (finite element solver) with the realistic boundary conditions which includes the vacuum region between the plasma and the DED coil.

The linear model is mainly applied to the following problems.

(1) The time development of the penetration process,
(2) The stability and the growth of the induced magnetic island,
(3) The effect of the plasma anomalous viscosity to the penetration process,
(4) The comparison with the DED experiments on small tokamak HYBTOK-II [3].

On the other hand, a m/n = 2/1 tearing type mode was triggered in the case of m/n = 3/1 DED configuration in the real experiment when the DED coil current was above the critical threshold [4]. When the 'mode onset' behavior appeared, the strong modification of the plasma toroidal rotation profile was observed. In the present work, a quasilinear model, in which the interaction between the background quantities (plasma current density and toroidal plasma rotation velocity) and the perturbations is taken into account, is also applied in order to reproduce the 'mode onset' behavior and understand its mechanism.

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