Effects of three-dimensional conducting structures on Resistive Wall Modes

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Surrounding the plasma with a sufficiently close conducting structure, it is possible to slow the growth rate of kink-like instabilities down to electromagnetic times. Indeed, the eddy currents induced in such conducting structures have a stabilizing effect, but they tend to decay, being the conductivity of the conducting wall finite, giving rise to the so-called Resistive Wall Modes (RWM).

Such modes are receiving an increasing attention, in view of their importance in present-day and future devices, like ITER, in setting limits in terms of achievable normalized beta. For this reason, it is of fundamental importance to make reliable predictions about the RWM stability boundary and to develop models which can be used for the design of an effective active control of such modes.

However, some open issues still remain in RWM modelling. One is the estimate of the stabilization effects due to plasma rotation and dissipation [1]. Another is the evaluation of the effects of the complex three-dimensional conducting structures surrounding the plasma [2,3]; this effect is investigated in the present paper.

In particular, the CarMa code [3,4] is used to analyze configurations of present-day and future devices in which the three-dimensional effects may provide a significant contribution to the overall stability properties, from the point of view both of quantitative estimates of growth rates and of the interpretation of the RWM spectrum.

The main idea is to decouple the interaction between the plasma and the conducting structures using a suitable surface *S*; in this way, one can use MHD solvers (like MARS-F [5]) inside *S* and three dimensional electromagnetic solvers outside *S* (like CARIDDI [6]). As a consequence, the overall computational tool shows a noticeable flexibility and effectiveness, because it allows the application of state-of-the-art developments from the point of view both of plasma modelling (e.g. the introduction of kinetic damping effects) and of pure electromagnetic modelling (e.g. the use of "fast" techniques for the treatment of huge computational models).

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