Abstract Submitted
for the APR06 Meeting of
The American Physical Society

Bicubic Bezier patches and finite element method for non-linear MHD codes. OLIVIER CZARNY, GUIDO HUYSMANS, DRFC / CEA Cadarache — For the numerical simulation of Edge Localised Modes, the presence of a separatrix (X-point) plays a important role for the relevant MHD instabilities i.e. external kink modes and ballooning modes. To investigate the MHD stability in plasmas with a separatrix, a new non-linear MHD code –named JOREK- is under development which treats both the closed field lines inside the separatrix and the open field lines outside. The current version of the code solves reduced MHD equations, using generalized finite elements which allow flexibility in the plasma geometry. Moving to more complete equations needs optimization of the code efficiency as far as memory is concerned, that is, decreasing the number of degrees of freedom required for a given accuracy. We have developed an approach based on bicubic Bezier surfaces which are commonly used in Computed Aided Design. This approach differs from Hermite's method in that it provides geometric continuity (G^1) while Hermite's formulation imposes more restrictive parametric continuity (C^1). As a consequence, Bezier formalism makes it easier to implement a grid refinement strategy (h adaptivity). Furthermore the method ensures continuous gradients of physical variables. We present some results from 2D MHD codes (Soloviev equilibrium, reduced MHD) in order to illustrate both validity and advantages of the approach.

Olivier Czarny
DRFC / CEA Cadarache

Date submitted: 13 Jan 2006 Electronic form version 1.4