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Nonlinear Numerical Modeling of Shape Control in IGNITOR in the Presence of 3D Structures R. ALBANESE, G. AMBROSINO, G. DE TOMMASI, A. PIRONTI, G. RUBINACCI, F. VILLONE, Consorzio CREATE, G. RAMOGIDA, ENEA, B. COPPI, MIT — IGNITOR is a high field compact machine [1] designed for the investigation of fusion burning plasmas at or close to ignition. The integrated plasma position, shape and current control plays an important role in its safe operation. The analysis of its behavior taking into account nonlinear and 3D effects can be of great interest for assessing its performances. In fact, the system was designed on the basis of an axisymmetric linearized model. To this purpose, we use a computational tool, called CarMa0NL, with the unprecedented capability of simultaneously considering three-dimensional effects of conductors surrounding the plasma and the inherent nonlinearity of the plasma behaviour itself, in the presence of the complex set of circuit equations describing the control system. Preliminary results already lead to the conclusion that the vertical position response is not much influenced by nonlinear and 3D effects, as the vertical stabilization controller is able to "hide" the differences in open-loop models. Here we assess the performance of the shape controller, by coupling the nonlinear plasma evolution in the presence of the 3D vessel with ports to the complex circuit dynamics simulating the integrated closed loop control system.

[1] B. Coppi, et al. Nucl. Fus. 53, 104013 (2013).

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