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P4.041 Plasma shape control assessment for JT-60SA using the CREATE tools

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The Satellite Tokamak Programme (STP) is the main project within the Broader Approach agreement. The STP includes the construction of the JT-60SA superconductive tokamak and its exploitation as an ITER "satellite" facility. In view of JT-60SA operations, Japanese and European scientists are developing different tools to support preliminary studies. In this context, a set of tools for the design and the validation of plasma magnetic control have been developed. Indeed, plasma magnetic control is needed since early tokamak operations to drive the currents in the external active coils, in order to achieve plasma breakdown and to track the scenario current waveforms. The CREATE electromagnetic modelling tools were used to design and validate a set of magnetic control algorithms for JT-60SA in an already proposed architecture for the magnetic control system.

A gap-based algorithm for plasma shape control is introduced in this paper. The proposed approach is based on the eXtreme Shape Controller, which is currently used at the JET tokamak. JT-60SA represents a relevant benchmark to further validate this control approach given the high beta regimes that are envisaged during its operation. Indeed, such regimes represent a challenge from the plasma magnetic control perspective.

Different test scenarios will be considered to assess the performance of the proposed shape controller, with the aim of defining an optimal set of gaps to be controlled. The capability of tracking different plasma shapes, as well as the one of rejecting the envisaged disturbances is considered. The result of this analysis suggests that a set of about 20 gaps equally spaced along the plasma boundary permits to control the shape with a root mean square error (computed on about 80 gaps) less than 1 cm, at steady state, when the specific disturbances for the flattop are considered.

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