A MARTE BASED SIMULATOR FOR THE JET VERTICAL STABILIZATION SYSTEM

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Validation by means of simulation is a crucial step when developing real-time control systems. Modeling and simulation are an essential tool since the early design phase, when the control algorithms are designed and tested. This phase is commonly carried out in offline environments such as Matlab® and Simulink® [1].

Simulation tools can be effectively adopted also during the deployment of real-time systems. Indeed, offline testing of the full real-time system permits to debug the code and to validate the real-time version of the control algorithms before running them on the plant [2]. Such an approach permits to minimize the risk of malfunctions and to reduce the time needed for the commissioning on the plant, yielding a costs reduction. Furthermore, by using such a simulation environment, it is possible to perform offline analyses addressed to the fine tuning of the control algorithms for specific operative scenarios.In order to adopt such an approach the real-time framework has to satisfy some key requirements: in particular it must allow to run the real-time code in an offline (non real-time) environment, interfacing it with a plant simulator. On the other hand, reliable plant models must be available.

A MARTe-based [3] simulator has been recently developed at JET tokamak [4], and it has been used to validate the new JET Vertical Stabilization (VS) system [5]. MARTe is the multi-thread framework used at JET to deploy hard real-time control systems. Thanks to the modularity of its software architecture, MARTe allows to interface the real-time control system with a C++ version of the CREATE plasma magnetic linear model [6]. Moreover, it allows to use different linear models (corresponding to different plasma scenarios) in different pulse phases, allowing to simulate a complete JET pulse.

This paper presents the software architecture of the MARTe-based simulator and it shows how this tool has been effectively used to evaluate the effects of Edge Localized Modes (ELMs) on the VS system [7]**.** A drop of energy due to an ELM occurrence is simulated by a variation of poloidal beta and internal inductance [8]. These parameters are considered as a disturbances applied to the plasma linearized model. By using the simulator it is possible to analyze different plasma configurations, extrapolating the limit of the new vertical amplifier in term energy of largest rejectable ELM.

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