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# MIMO shape control at EAST tokamak: simulations and experiments

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Over the last few years, new magnetic control algorithms have been developed and tested on the EAST tokamak. The aim is to improve the overall plasma performances and to open the way to the control of advanced plasma magnetic configurations [1]. In order to achieve such an objective, an architecture based on a MIMO plasma shape controller was proposed in [2].
This architecture relies on specific control algorithms for plasma vertical stabilization and for the current control in the Poloidal Field (PF) circuits. These components have been designed exploiting the CREATE magnetic models. In particular, a voltage-driven Vertical Stabilization system, a controller for the plasma centroid position, and a multi-input-multi-output (MIMO) PF currents controller were implemented and experimentally validated in 2016-2017 [3] [4].
The plan for the 2018 EAST experimental campaign is to test and validate the MIMO plasma shape controller that relies on the architecture tested in 2016-2017, and that adopts an approach similar to the one used by the JET's eXtreme Shape Controller. Such an approach will enable the integrated control of the plasma boundary and of the heat flux on the divertor plates.
In this paper the simulation results obtained with the CREATE modelling tools are compared with the ones obtained experimentally for different setups of the magnetic control system.

[1] G. Calabrò et. al., «EAST Alternative Magnetic Configurations: Modelling and First Experiments,» Nuclear Fusion, 2015.
[2] R. Albanese et. al., «A MIMO architecture for integrated control of plasma shape and flux expansion for the EAST tokamak,» in IEEE Multi-Conference on Systems and Control, 2016.
[3] R. Albanese et. al., «ITER-like Vertical Stabilization System for the EAST tokamak,» Nuclear Fusion, 2017.
[4] G. De Tommasi et. al., «Model-based plasma vertical stabilization and position control at EAST,» FED, 2018.

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