Experimental results on elongation control using dynamic input allocation at FTU

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We report on experimental results related to a recently proposed control scheme for the regulation of plasma elongation using the poloidal field coils available at FTU [1].
In FTU the elongation is directly related to the current flowing in the F (Feeedback) coil, through an approximately known nonlinear static map. On the other hand the F coil is already used, together with the V (Vertical) coil, for the horizontal position control.
The developed algorithm is based on a dynamic allocation scheme for input redundant plants, whose details and general theoretical results have been given in [2]. This technique is expected to be practically useful in dealing with various control problems arising in the fusion field, due to the presence of multiple actuators characterized by different features, like magnitude and rate saturation levels. For example an extension of the allocation technique presented in [2] has been used in [3] to deal with a saturation avoidance problem for the poloidal field coils used in the shape control system of JET.
In this application the proposed allocation technique allows to couple the action of the two actuators F and V in order to slowly regulate the current in the F coil to a desired reference value, without modifying the horizontal position control performance guaranteed by the original control scheme and without violating the actuators' limitations.
As a second step, an elongation control loop is closed in feedback using elongation measurements. This is obtained through the inversion of the nonlinear static map that directly relates the elongation to the current in F.
In this paper we discuss the experimental results and compare them with the results predicted by the simulations and with the preliminary experimental results presented in [1].

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