# Shape reconstruction and eddy currents estimation via Kalman Filter at the EAST tokamak

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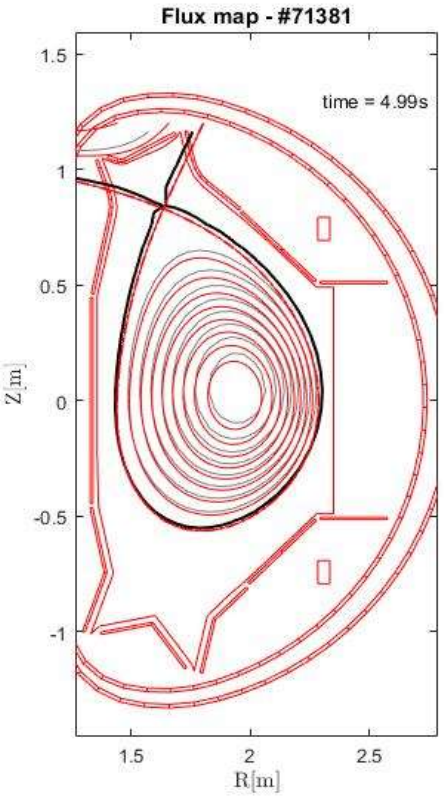
Plasma shape control is a core issue for thermonuclear fusion reactors. In order to achieve high control performances, the magnetic control system of a tokamak device must rely on a fast and accurate shape reconstruction algorithm, which is capable of precisely estimating the poloidal flux map that best fits the available experimental measurements at every control cycle. In this work, a possible solution to this problem is discussed, based on the well known Kalman filtering theory. The CREATE equilibrium codes [1], [2] have been used to generate linearized models of the plasma response, which can be embedded in an optimal state observer in order to achieve a fast and accurate reconstruction of the plasma shape, plus an estimate of the eddy currents induced in the passive structures. This reconstruction is also suitable for a real-time implementation, as it entails only matrix multiplications and a single matrix inversion. As a testbed, the proposed solution has been applied to experimental data coming from the EAST tokamak.




*1. Comparison between the flux map of the EAST tokamak reconstructed using Kalman filtering (in gray) and the one computed by EFIT (in red).*

[1] R. Albanese e F. Villone, «The linearized CREATE-L plasma response model for the control of current, position and shape in Tokamaks,» *Nuclear Fusion,* vol. 38, 1998.

[2] R. Albanese, G. Calabrò, M. Mattei e F. Villone, «Plasma response model for current, shape and position control at JET,» *Fusion Engineering Design,* vol. 66, pp. 725-728, 2003.