ADVANCES IN THE EXPERIMENTATION OF EXTREMUM SEEKING TECHNIQUES TO MAXIMIZE THE RF POWER ABSORPTION IN FTU

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In this paper we will report on the advances in the experimentation of extremum seeking techniques on the horizontal positioning system of the plasma in the Frascati Tokamak Upgrade (FTU). This strategy allows to maximize in real time the coupling between the plasma and an emitting RF antenna consisting of an array of waveguides (grill) emitting in the Lower Hybrid (LH) range. Maximizing the coupling between the antenna and the plasma leads to a significant reduction of the reflection coefficient, which is a convex function of the density of the first layer in front of the grill. This has two important advantages: first the power absorbed by the plasma and the corresponding heating effect is maximized; secondly, the system is kept in a good operating condition, avoiding annoying temporary power shutdowns due to overly high levels of power reflected towards the grill. The dynamic extremum seeking technique had already shown very desirable results on the experimentation on one of the three LH grills available at FTU. We report here on new experimental results where the experimentation is extended to all the grills, consisting of a total of 3x48=144 cells. The experiments show a satisfactory behavior of the system, which is not trivial to achieve because the geometry of the three grills is not uniform. Interestingly, the system's response is sufficiently uniform over the three grills and the optimizing action leads to an overall improvement of the power absorbed by the plasma. Additional results will be presented on the use of a modified extremum seeking algorithm to increase the robustness of the approach towards disturbances affecting the measurement of the reflected power. The experiments are carried out by relying on a reduced set of online measurements to keep the architecture of the control system simple. It is shown that the reduced measured are sufficient to gather the necessary information on the reflected power on each grill.