

Real-Time Feedback Control System for Plasma Position Stabilisation in ADITYA-U Tokamak

Wednesday, 24 October 2018 08:30 (20 minutes)

The ADITYA-U tokamak ($R_0 = 0.75$ m, $a = 0.25$ m) is designed to have shaped plasmas in both single and double null diverter configurations. It is quite well known that sustaining a shaped plasma in tokamak requires very good plasma column position control, both horizontal and vertical. A proportional–integral–derivative (PID) based control system has been designed and operated to achieve horizontal and vertical plasma positions control in ADITYA-U tokamak. In this control system, the transfer function model [1] of control power supply and different position diagnostics has been incorporated such that whole system fulfils the stability criteria of the whole control system. In order to incorporate effect of change in radius of plasma column and the vessel eddy current on the position measurements, new adaptive techniques [2] are incorporated to achieve plasma position regulation with minimum error. Detailed comparisons have been carried out between the results obtained with the conventional PID approach and adaptive method approach. Furthermore, the system has been trained to take appropriate actions during the disruption or plasma failure in the tokamak. The complete system has been rigorously tested with sample signals before implementing to the ADITYA-U plasma discharges. The control system is integrated to the composite plasma control system of ADITYA –U. The complete design, installation, operation, training of the system along with all the relevant testing will be presented in the paper.

Country or International Organization

India

Paper Number

FIP/P3-58

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Session Classification: P3 Posters

Track Classification: FIP - Fusion Engineering, Integration and Power Plant Design