

# Feedback Position Control System for Plasma Horizontal Position in a Small Tokamak

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Yasunori Mizuno

The purpose of the present study is to realize a system for holding a plasma apt to displace outwards repidly and extinguish stably for a long time by a vertical magnetic field in a tokamak apparatus (an apparatus to confine magnetically toroidal plasma for the thermonuclear fusion research) of small type. We developed the following various circuetes for this system and obtained corresponding good results.

1. A timing control circuit to detect the luminescence of the plasma at its onset and apply the vertical magnetic field synchronously with the luminescence: the plasma could be held from the initial phase in the central portion of a vecuum vessel.

2. A circuit provided with plural units, each consisting of a capacitor and a constant-current transistor, and to apply a rectrangular vertical magnetic field by discharging the capacitors at the same time: the vertical magnetic field rose rapidly and was hardly attenuated, and could prevent the plasma form displacing horizontally.

3. A drive circuit provided with the adove-mentioned units connected for both polarities and to generate the current for a control vertical magnetic field by successively (digitally) discharging some of the capacitors: the number of the capacitors discharging with constant current changed corresponding to a digitized input signal and a digital current dirve with the maximum 80Ap-p thus became possinble.

4. A PID feed-back control circuit to detect and compute the horizontal displacement signal of the plasma and to output the deviation of the computed displacement from a preset one to the drive circuit: the plasma was held from the initial phase exactly at the preset displacement, the range of the fluctuation of displacement was reduced to 0.5cm from 3.5cm and the duration of plasma current was elongated to 2.3ms form 1.6ms.

This thesis describes the principle and operation of these various circuits, and the whole effect of the feedback control system constructed with these circuits.