ALTERNATE METHODS OF VERTICAL PLASMA CONTROL
IN THE ALCATOR C-MOD TOKAMAK

by

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Submitted to the Department of Nuclear Engineering
on May 8, 1998 in Partial Fulfillment of the
Requirements for the Degree of Master of Science in
Nuclear Engineering

ABSTRACT

This thesis investigates alternate methods of controlling the vertical position of the plasma in the
ALCATOR C-Mod Tokamak. The purpose of this work is to examine alternative methods of
controlling the plasma position that can be adopted to improve performance over the current
system, which uses a proportional-derivative (PD) control system actuated through a pair of
outboard equilibrium field coils (EFC). The first part of this investigation examines the
possibility of using inboard ohmic heating coils (OH2) as the controlling coils. A coupling
transformer was designed to connect a large amperage/low bandwidth power supply to a small
amperage/high bandwidth power supply, removing the need for an expensive large and fast
power supply. Both PD control laws and full state feedback laws were also compared for
performance. A rigid displacement model of the plasma motion was developed that took into
account a model of induced currents in the vacuum vessel and coils.

The results of the analysis concluded that there were moderate speed advantages to using state
feedback on the OH2 coils, but these were outweighed by the robust operation of EFC PD
control. No design achieved a decisive margin of improvement over the current control system.

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