AUTOMATED FAULT DETECTION FOR DIII-D TOKAMAK EXPERIMENTS*

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During experimental operation of the DIII–D tokamak, hundreds of subsystems must operate correctly and simultaneously for a completely successful plasma discharge. In the past, verifying proper operation of the subsystems which were most prone to failure was done manually by human operators after each shot. Because of the tedious nature of this task and the large number of systems, inoperative or malfunctioning systems were sometimes not detected until several experimental discharges had passed. Occasionally, problems were not detected until days later. Other more reliable systems typically were not checked on every shot. A problem with one of these systems, unless catastrophic, might go undetected even longer.

During 1998, an automated fault detection software system was developed and implemented. The Fault Identification and Communication System (FICS) executes automatically after every plasma discharge to check dozens of subsystems for proper operation and communicates the test results to the operator. It attempts to identify the source of any experimental discharge failure as well as system anomalies which could cause a future plasma discharge to fail.

The only commercial software used to implement this system were C and FORTRAN compilers. The user interface and the expert system which comprises the core of the fault detection software uses freely available software packages. The FICS software system to be described here is now used routinely during DIII–D operations and has led to an increase in tokamak availability.

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