A Reliability Analysis on Safety-Related Digital Module in Nuclear Power Plants

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Abstract

Component failure rates and integrated system reliability of a Foxboro Spec 200 Micro module, which was developed with digital technology for the nuclear power plant control and protection, were analyzed. Analysis tool of the study was the part stress analysis technique suggested by the MIL-HDBK-217F. The input data such as base failure rates, operating factors and environmental factors etc. for the study was selected from the generic data sets of MIL-HDBK-217F. The calculation results shows that the average failure rate of digital components in the Foxboro Spec 200 Micro module are higher than that of conventional analog components. And the average reliability drop ratio of the module decreases from 5.7 % to 3.4 % for each two years operating interval up to 20 years assuming the normal operating conditions.

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SOFTWARE VERIFICATION AND VALIDATION METHODOLOGY FOR ADVANCED DIGITAL REACTOR PROTECTION SYSTEM USING DIVERSE DUAL PROCESSORS TO PREVENT COMMON MODE FAILURE

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Abstract

The Advanced Digital Reactor Protection System (ADRPS) with diverse dual processors is being developed by the National Research Lab of KOPEC for ADRPS development. One of the ADRPS goals is to develop digital Plant Protection System (PPS) free of Common Mode Failure (CMF). To prevent CMF, the principle of diversity is applied to both hardware design and software design. For the hardware diversity, two different types of CPUs are used for Bistable Processor and Local Coincidence Logic Processor. The VME based Single Board Computers (SBC) are used for the CPU hardware platforms. The QNX Operating System (OS) and the VxWorks OS are used for software diversity. Rigorous Software Verification and Validation (V&V) is also required to prevent CMF. In this paper, software V&V methodology for the ADRPS is described to enhance the ADRPS software reliability and to assure high quality of the ADRPS software[5].