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MATHEMATICAL RELIABILITY MODEL FOR MINIMAL CUT SET ANALYSIS OF ELECTRICAL SYSTEM WITH WHOLE STANDBY REDUNDANCY

Abstract

In this paper the mathematical reliability model of repairable electrical system with whole standby redundancy for determination cut set probability indexes is proposed. Cut set probability indexes are used for down state courses analysis and for creating recommendation for system reliability improving. The system is composed of three components: generator, converter, and storage battery. The generator and the converter are made up the main subsystem, and the storage battery is made up reserve subsystem. The reliability of such system is formalized by dynamic fault tree. System down state is occurred if both main and reserve subsystems are in down state. Main system down state is occurred if even generator or converter is in down state. Reserve system down state is occurred if storage battery is discharged or faulted. Time to failure for all components is distributed by Weibull and repairing time for system is distributed by exponentially. Dynamic reliability behaviors are proposed to define by scale function. For proposed reliability model such function are used for description of two coupled change load event. The first event consists in operational component of main subsystem turn off if other one is faulted. And the second events consist in reserve subsystem turn on if main subsystem is faulted. Based on dynamic fault tree the state and events model of system is formed. Such system includes five states, three of which are operational. Six events can occur in the system, two of which are failures. Using states and events model is constructed split homogeneous Markov model of system. In such model states are split into 40 phases and events split into 48 transitions. By split homogeneous Markov model is defined probability indexes of both cuts and they important order is recognized. The main advantage of proposed mathematical reliability model of electrical system with whole standby redundancy consists in treating of load changes impact on cut probability indexes.