Exsys Case Study

Automatic Reconfiguration and Restoration of Shipboard Power Systems During Battle

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Electric-power is critical in US Navy ships to supply energy to sophisticated systems for weapons, communications, navigation and operation. Faults in a shipboard power system (SPS) may occur during naval conflicts as a result of direct destruction of specific electrical components or widespread faults due to battle damage. These may interrupt the supply of electrical energy to systems that are not actually faulty or damaged.

Consistent with the U.S. Navy goals to reduce manning and increase system survivability, automatic reconfiguration of the electrical network in a shipboard power system is critical for quickly restoring power as soon as possible after battle damage. Also reconfiguration is critical to meeting operational requirements such as changing from one mission to another, avoiding possible over-loading of the system or taking systems offline.

Exsys Corvid® was used to build a rule-based knowledge automation expert system for reconfiguration of electric-power systems on naval ships. It determines the operational control necessary to restore power supply to de-energized loads after battle damage, and prevent cascading faults.

The core of the system is the rule-based expert system (RBES) that consists of a set of rules, which represent the decision-making process of experts in performing reconfiguration for load restoration. The reconfiguration for restoration methodology consists of various systems such as: a geographical-information system (GIS), failure-assessment system (FAST) and the expert-system-based restoration system (XRest).

The knowledge automation expert system methodology addresses all the issues arising because of the complexity of shipboard power systems, and determines control actions for restoring as many of the de-energized loads as possible. It considers the priority of loads and operating constraints such as generator power capacity, cable current ampacity, and load node-voltage operating limits. The method includes two expert systems that use measured system data, topology information and protective device prefault and post-fault statuses to determine the present fault conditions and de-energized loads, and recommends the reconfiguration control actions to restore as many loads as possible.

Reference Links:

Looking at structure: http://psalserver.tamu.edu/main/papers/Butler_Expert_sys.pdf
Looking at complexity: http://psalserver.tamu.edu/main/papers/018%20Butler%20Sarma%20Hicks.pdf