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Project Title: Design of Reliability centered Maintenance (RCM) Procedure in Transmission & Subtransmission Network and Development of Saba Software for RCM.

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Keywords:

Reliability Centered Maintenance, Markov model, Inspection rate, Maintenance rate, Cost- _Benefit Function, time-based maintenance, condition-based maintenance, run-to-fail

Project Necessity:

Maintenance scheduling is a vital part of asset management in power systems. Since the maintenance strategies have a direct effect on operation cost, a proper maintenance plan would greatly manage sources of utility. On the other hand, in viewpoint of system reliability, maintenance action would be crucial because the gradual deterioration process of system's elements would result in loss of loads and high replacement costs. Therefore, preparing a proper model for maintenance is necessary in deregulated systems. In this project, a nonperiodic mode based maintenance model is proposed for transmission elements. Based on the basic model for nonperiodic maintenance scheduling, six maintenance strategies are introduced considering the concept of major maintenance and minor maintenance. In mode-based analysis, each failure mode of element has its own maintenance strategy which can be one of the three maintenance group, namely, TBM, CBM and RTF. Therefore, for a given element with the specified failure modes, there are maintenance strategies as many number as failure modes. Each maintenance strategy refers to special inspection and maintenance regime. Considering all of maintenance actions, it is required to exit the element from service again and again but this is not possible in the practical viewpoint. So the maintenance strategies should be synchronized to reduce the number of service interruption. Moreover, synchronizing can result in reduction of fixed cost of maintenance. Therefore, this paper tries to present a proper algorithm for the synchronization of strategies obtained from mode-based analysis.

Project Goals:

- Cost saving from time based maintenance to reliability centered maintenance.

- Power marketing will have high benefit/cost ratios.
- Create a cost-effective maintenance strategy to address dominant causes of system reliability.
- It is a systematic approach to defining a failure analysis of power system by deterministic reliability calculation and finds the priority of substation and transmission line in power system program composed of cost-effective tasks that preserve important functions.
- RCM emphasizes the use of Predictive maintenance (PDM) techniques in addition to traditional preventive measures.

The result is a maintenance program that focuses on elements and location that cause more influence on benefit and cost. Calculate the reliability of large scale of power transmission system and find the priority of elements of system in maintenance strategy.

Abstract:

Reliability Centered maintenance, often known as RCM, is a process to ensure that system continues to do what their users require in their operating requirement context. It is generally used to achieve improvements in fields such as the establishment of safe minimum levels of maintenance, changes to operating procedures and strategies and the establishment of capital maintenance regimes and plans related to reliability of system. Successful implementation of RCM will lead to increase in cost effectiveness, system uptime, and a greater understanding of the level of risk that the organization is presently managing.

This project is divided into following areas of research:

- Identify the operating reliability of the system and its elements.
- Write a Failure Mode Effects and Critically Analysis (FMECA)
- Determine the situation and significant of power transmission substations and line to specify the premiership of maintained location.
- Do sensitivity analysis of system reliability according to element reliability parameters like permanent failure rate and repair time to determine priority of system elements.
- Apply the “RCM logic”, which helps determine the appropriate maintenance tasks for the identified failure modes in the FMECA.
- Once the logic is completed for all elements in the FMECA the resulting list of maintenance is “packaged”, so that the periodicities of the tasks are rationalized to be called up in work packages.

Steps and Methodologies:

1. priority of substations and lines based on: 1. Outage of lines and substations parameters, 2. the parameters for number of failure.

2. Priority of system elements: 1. Determine the importance of system elements, 2. Determine the situation of system elements, 3. show the importance- situation diagram.

3. failure modes and effects analysis(FMEA): identify the Failure modes and the Causes of failures for transformer current transformer, Breaker, line.

4. Maintenance strategy for bay: this project introduces six plans for maintenance in each failure mode. The related Markov model for each plan is proposed, too. Given these Markov models, attempts are made to determine the best strategy of maintenance and the optimum rate of inspection and maintenance for each mode. Furthermore, to increase the practicality of the presented method and to reduce the overall maintenance cost, the maintenance plans of the failure modes of an element are coordinated, together. Finally, applicability of the presented method is demonstrated using an illustrative example.

Main Results (technical outputs, patents, papers, books, reports, etc.):

Development RCM module in SABA.

Reports in eleven phases Presented.

Papers:

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