Optimization and selection of maintenance policies in an electrical gas turbine generator based on the hybrid reliability-centered maintenance (RCM) model

ABSTRACT

The electrical generation industry is looking for techniques to precisely determine the proper maintenance policy and schedule of their assets. Reliability-centered maintenance (RCM) is a methodology for choosing what maintenance activities have to be performed to keep the asset working within its designed function. Current developments in RCM models are struggling to solve the drawbacks of traditional RCM with regards to optimization and strategy selection; for instance, traditional RCM handles each failure mode individually with a simple yes or no safety question in which question has the possibility of major error and missing the effect of a combinational failure mode. Hence, in the present study, a hybrid RCM model was proposed to fill these gaps and find the optimal maintenance policies and scheduling by a combination of hybrid linguistic-failure mode and effect analysis (HL-FMEA), the co-evolutionary multi-objective particle swarm optimization (CMPSO) algorithm, an analytic network process (ANP), and developed maintenance decision tree (DMDT). To demonstrate the effectiveness and efficiencies of the proposed RCM model, a case study on the maintenance of an electrical generator was conducted at a Yemeni oil and gas processing plant. The results confirm that, compared with previous studies, the proposed model gave the optimal maintenance policies and scheduling for the electrical generator in a well-structured plan, economically and effectively.

Keyword: Policy selection; Optimization; Reliability-centered maintenance (RCM); Analytic network process (ANP); Hybrid linguistic failure mode and effect analysis (HL-FMEA); Failure modes (FMs); Oil and gas plant; Co-evolutionary multi-objective particle swarm optimization (CMPSO); Developed maintenance decision tree (DMDT)