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Application of fuzzy failure mode, effect and criticality analysis (fuzzy FMECA) with extended rule of criticality ranking assessment: A case study in ghee and soap industry

Abstract

This paper presents the application of fuzzy FMECA for item criticality ranking assessment. A case study from Yemen's ghee and soap industry was used, which focuses on a critical production system of seaming process. The proposed fuzzy FMECA framework is divided into three main phases. The first phase is the FMECA procedure that is commonly applied with criticality analysis is performed based on risk priority number (RPN) calculation of severity (S), occurrence (O) and detection (D) parameters measures. The second phase is the estimation of RPN based on the fuzzy approach, which is carried out based on Gaussian membership function application. The third phase is the final criticality ranking assessment process to prioritize the production components under study. In this phase, an extended rule is introduced to avoid/minimize overlapping values in criticality ranking determination. A case study on a critical production system that consists of overall 32 components was used for framework validation. The MATLAB fuzzy logic toolbox was used to assist the fuzzification process towards RPN numbers estimation. The overall results of FMECA with comparison values of typical RPN and fuzzy RPN are presented. The discussion on the implications and benefits of the extended rule application towards final criticality ranking determination is then given.

Keywords

Criticality ranking; FMECA; Fuzzy FMECA; Industry case study