

FUZZY INFERENCE FOR ASSESSING PROCESS LIFETIME PERFORMANCE

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ABSTRACT. *Process capability studies, which use a capability index to provide numerical measures on whether a process conforms to the capability prerequisite set in the factory, have been successfully applied by companies to compete with and lead high-profit markets by evaluating quality and productivity performance. The lifetime capability index L_{tp} has been proposed to measure process lifetime performance, wherein the output lifetime measurements are considered precise. In the present study, we study the more realistic situation where the process lifetime output data are imprecise. Using the approach taken by [4-5] with some modifications, a set of confidence intervals, one on top of the other, is used to produce the triangular shaped fuzzy number for a fuzzy estimate of the lifetime capability index L_{tp} . With the sampling distribution used for the estimation of L_{tp} , two useful fuzzy inference criteria, the critical value and the fuzzy p -value, are proposed to assess the process lifetime performance based on L_{tp} . The presented methodology takes into consideration a certain degree of imprecision in the sample data and leads to a three-decision rule with a four quadrants decision-making plot. The fuzzy inference for assessing process lifetime performance is a natural generalization of the traditional test; when data are precise the proposed test is reduced to a classical test with a binary decision.*

Keywords: Lifetime capability index, Conforming rate, Fuzzy sets, Fuzzy hypothesis testing, Fuzzy p -value, Critical value

1. Introduction. Statistical models and methods for lifetime data and other survival data are used extensively in many fields, including the biomedical sciences, engineering, and management. Examples of lifetime data include the times-to-failure of machine processes and components in industrial reliability, the duration of strikes or periods of unemployment, and the survival times of patients in a clinical trial. There are situations