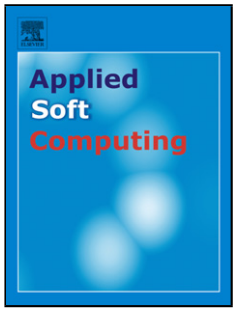


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# A Novel Phase I Fuzzy Profile Monitoring Approach based on Fuzzy Change Point Analysis

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## Highlights

•In this paper, a new method based on the fuzzy change point technique was proposed for Phase I fuzzy profile monitoring.

•The proposed method has the best performance compared to rival methods.

•The proposed method has a unique feature in comparison with competing methods. The method not only signals whenever the process is out-of-control in an SPC context, but it also provides an estimate of the time when the process went out-of-control.

## Abstract

In many applications of quality control, the quality of a product or service is described by its profile, which is a relationship between a response variable and one or more independent variables. However, in real world applications, vagueness, imprecision and uncertainty in data is inevitable and hence profile monitoring of fuzzy data is an important issue. In this paper, we discuss the phase I of fuzzy profile monitoring, when the response variables are fuzzy and vague, and propose a new method for estimating the change point. The proposed method, called fuzzy change point technique, is based on the principle of Maximum Likelihood Estimator (MLE) with fuzzy observations. The performance of the proposed method is evaluated by its ability to satisfy the goals of phase I fuzzy profile monitoring and is based on "the probability of an out-of-control signal", and the accuracy of the change point estimator. Simulation results show that this method outperforms methods known to date. Besides, we are not aware of any other method that is able to determine the real time of change in a process. The applicability of the proposed method is demonstrated by a case study in ceramic tile industry.

**Keywords**: Change point analysis, EM algorithm, Fuzzy quality control, Fuzzy simple linear profile, Phase I Fuzzy Profile Monitoring