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A NEW DIAGNOSIS SYSTEM BASED ON FUZZY REASONING TO DETECT MEAN AND/OR VARIANCE SHIFTS IN A PROCESS

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Abstract. *Statistical process control is a very useful method to improve the product quality and reduce reworks and scraps. In a production environment, control charts are the most important tool to determine whether a process is in-control or out-of-control. Control charts are to detect the occurrence of the shifts in a process rapidly so that their causes can be found and the necessary corrective action can be taken before a large quantity of nonconforming products are manufactured. The determination of variability affects the cost and the quality in a process. Considering the cost that is caused by delay in defining the variability, it is important to determine the variation correctly and quickly in a production process. This paper presents a new method based on a fuzzy inference system for determining shifts in the process. The Fuzzy Inference Control System includes four stages to detect and distinguish mean and/or variance shifts in the quality characteristic. Furthermore, the performance of the proposed method is examined and compared with that of Shewhart Control Charts by evaluating Type II error. In addition, the proposed model is evaluated by comparing performances of the joint X-bar and R charts, and X-bar and s charts for different sample sizes.*

Keywords: Statistical process control, Shewhart control charts, Fuzzy logic, Fuzzy inference system

1. **Introduction.** It is expected that production processes operate in control every time. However, one or more assignable causes associated with the machines, the operators, or the materials may occur resulting in a shift of a process to an out-of-control state. When that happens, a significant percent of the process output does not conform to required specifications. Therefore, it is critical to detect shifts in a process regarding the quality and cost. If the time between variation occurrence and its determination is considered, the determination of the variation is very important to improve the product quality and reduce rework which is a fundamental industrial problem.

The development of intelligent quality control systems is essential. In the near future, control systems will take data from the product and decide whether the process is in control or not. Several studies on this subject have been made by using artificial intelligence techniques. One of the recent research areas is fuzzy logic applications in Statistical Process Control (SPC).

Rowlands and Wang [1] explored the integration of fuzzy logic and control charts in order to create and design a fuzzy-SPC evaluation and control method. Hsu and Chen [2]