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A BI-CRITERIA FOUR-FACTOR FLUCTUATION SMOOTHING RULE FOR SCHEDULING JOBS IN A WAFER FABRICATION FACTORY

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Abstract. *A bi-criteria four-factor fluctuation smoothing rule is proposed to improve the performance of scheduling jobs in a wafer fabrication factory. The proposed bi-criteria four-factor fluctuation smoothing rule has some innovative characteristics. First, the remaining cycle time of a job is accurately estimated by applying the fuzzy c-means and fuzzy back propagation network (FCM-FBPN) approach. Second, two tailored nonlinear forms of the fluctuation smoothing rules are obtained to enhance the balancing and responsiveness. Third, the two tailored nonlinear fluctuation smoothing rules are merged into a bi-criteria rule to consider two performance measures (average cycle time and cycle time variation) at the same time. Finally, the content of the bi-criteria rule can be tailored for a wafer fabrication factory with four adjustable factors. To evaluate the effectiveness of the proposed methodology, production simulation was applied. According to the experimental results, the proposed methodology is a Pareto optimal solution by reducing the average cycle time and cycle time standard deviation at the same time.*
Keywords: Wafer fabrication, Scheduling, Fuzzy, Neural, Tailored, Simulation

1. **Introduction.** Scheduling in a wafer fabrication factory is a very difficult task. Kim et al. [1] classified the production scheduling problems in a wafer fabrication factory into three categories: job release control, job scheduling in serial processing workstations, and batch scheduling in batch processing workstations. Job scheduling approaches can be further divided into global approaches and local approaches. Local scheduling approaches usually focus on photolithography workstations, while global scheduling approaches can be applied to all workstations in a wafer fabrication factory.

Many studies (e.g. [2,3]) have shown that applying global scheduling approaches (such as first-in first out (FIFO), earliest due date (EDD), least slack (LS), shortest processing time (SPT), shortest remaining processing time (SRPT), critical ratio (CR) FIFO+, SRPT+, and SRPT++) to a wafer fabrication factory does not produce very good results. Nevertheless, the research focused on scheduling jobs in a wafer fabrication factory is a very important issue at present [4]. To tackle this problem, Lu et al. [3] proposed two "stochastic" scheduling rules, a fluctuation smoothing (FS) policy for the variance of the cycle time (FSVCT) and a fluctuation smoothing policy for a mean cycle time (FSMCT), in which the remaining cycle time of a job is considered and therefore needs to be estimated. However, the remaining cycle time of a job is highly stochastic because it depends not only upon the factory conditions but also on the progress of the other jobs. Lu et al.