A COLLABORATIVE FUZZY-NEURAL APPROACH FOR INTERNAL DUE DATE ASSIGNMENT IN A WAFER FABRICATION PLANT

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ABSTRACT. *Though many of the previous studies have been devoted to internal due date assignment in a wafer fabrication factory (wafer fab), very few among them considered the allowance added to a completion time forecast. In this way, the probability of on-time delivery is only about 50%. Methods based on confidence intervals generate completion time forecasts with very wide ranges and are not practical. From a novel viewpoint, Chen and Wang (2010) incorporated the hybrid fuzzy c-means and back propagation network (FCM-BPN) approach with a nonlinear programming (NP) model for the same purpose. The FCM-BPN-NP approach is modified in this study with some innovative treatments. At first, the BPNs of all categories are applied to predict the completion time of a job. After predicting the completion time, the inclusion interval can be derived with the NPs of all categories. Subsequently, a two-stage aggregation procedure is applied to measure the consensus among the inclusion intervals that are then aggregated in a collaborative way. Parameters in the BPN will be modified twice to determine the upper and lower bounds. Finally, the consensus is fed into another BPN for refining the completion time forecast. According to experimental results, the proposed methodology outperformed many existing approaches in reducing the average allowance. The advantage over the FCM-BPN-NP approach was up to 17%. In addition, the proposed methodology also guarantees that all jobs can be finished before the established internal due dates, without adding too large a fudge factor, and without sacrificing the accuracy of the completion/cycle time forecasts.*
Keywords: Internal due date, Wafer fabrication, Back propagation network, Fuzzy c-means, Nonlinear programming, Fuzzy intersection

1. **Introduction.** Due date assignment/quotation is an important topic in shop floor control [1]. It occurs when a firm is asked to provide a due date to its customer during sales negotiation [2]. The firm must provide a price reduction if the best due-date they can offer is far away from the one expected by the customer. Conversely, the looser the due date is set, the higher the probability that the job will be completed or delivered on time. It is very important to maintain a good reputation with the customers. All these considerations are conflicting and make due date assignment a difficult problem. Nevertheless, assigning tight but attainable due dates is still being pursued [3].

A due date might be internal or external. An internal due date is generally based on the completion time of the job as predicted by the production control staff, while an external due date is mostly dictated or negotiated by the customer. Information about the internal due date must be provided to the sales representative for negotiating the external due