Integration of Interdependent Textile Process C95-13

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Abstract:

To reach world class status, companies must break down the barriers between departments which rely upon each other as supplier of inputs or receiver of outputs. Few companies attempt optimization and integration beyond a particular process. The overall optimum could be significantly improved when these interdependencies are considered.

In this study a system is being developed within a value chain concept to optimize spinning performance and yarn quality. Crucial to this task is the identification of activities and their input/output measures that influence any downstream process performance/quality. In our model several successive processes are being studied. These are mix laydowns, opening, carding, breaker drawing, intermediate drawing, finisher drawing, combing, roving, and ring spinning. Available measurements from these processes are being collected from our industrial partner and addition testing is being conducted to provide a more complete set of information.

During the first four months of this project our laboratory has purchased software and developed software to assist in data collection and model development. The software studied to gain an understanding of its full potential. Our computer has been linked with our industrial partners computer to ease the burden of data collection and input. A data set for a preliminary analysis should be developed within the next month.

Overall Objective:

Our primary objective is to develop novel integration architectures for interdependent textile processes using intelligent modeling, optimization and control routines and to demonstrate their feasibility on-site through the collaboration of our industrial partner. It is anticipated that the successful demonstration of such integration strategies will result in substantial improvements in productivity, efficiency and product quality.

Introduction:

The key question that we are addressing is: How do we integrate a number of critical functionalities in the textile manufacturing process, and how do we optimize/control the operation of related systems in order to increase productivity and improve product quality? Potential barriers include the lack of hardware/software uniformity and compatibility on the manufacturing floor. In most textile mills, monitoring and control needs are typically addressed on an independent and distributed basis. A new approach is needed to enhance the competitiveness of the U. S. Textile industry that views the operation of coupled systems in a hierarchical and interactive way. Although the industry recognizes the integration need, very few serious attempts have been undertaken to resolve the technical issues involved. The risk in achieving our objective is considerably reduced by the presence of our industrial partners in our research team.
Their active participation has made available to us monitoring data, support and advice in the execution of our work. Their willingness to support our developments through beta testing and experimentation is vital and encouraging.

Methodology:

Models will be developed based on the input/output data from subsequent processes and environmental measures. Principal Component Analysis (PCA), Principal Component Regression (PCR) and Partial Least Squares (PLS) will be employed for the modeling task. Data handling systems will be developed/used to process data. PCA, PCR, and PLS optimization algorithm will be called upon to carry out the optimization task. Commercial packages will also be used to test the effectiveness of the optimization procedure.

Results/Conclusions:

Preliminary trials have been conducted to study the potential of the software. Significant data has been collected from our industrial partner. However, the data set is still incomplete and no significant results are available at this time.

Education:

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