ARTIFICIAL NEURAL NETWORK EMBEDDED EXPERT SYSTEM FOR DESIGN OF WOVEN FABRICS

by
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woven fabrics - computer applications

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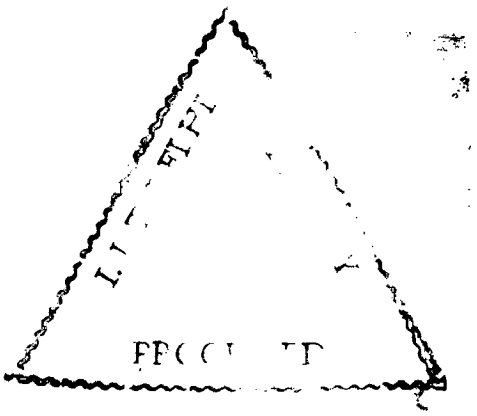

CERTIFICATE

1. I am satisfied that the thesis presented by Mr. S. B. Muttagi is worthy of consideration for the award of the Degree of **Doctor of Philosophy** and is a record of the original bonafied research work carried out by him under my guidance and supervision and that the results contained in it have not been submitted in part or full to any other University or Institute for award of any degree/diploma.

2. I certify that he has pursued the prescribed course of research.

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Dedicated to dear
Akka and Appa

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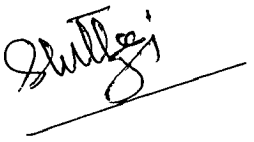

ABSTRACT

This research work proposes total material design of wool, wool-polyester and polyester-viscose blended woven suiting fabrics by embedding artificial neural network in a knowledge base containing fabric design specific empirical rules. The trained and generalized radial basis function artificial neural network has been incorporated to model the structure-property relationships of the woven suiting fabrics. Designing process is simplified by providing graphic user interface to interact with the system.

It has been found that, artificial neural networks produced the least error, as well as, lower spread in the error, as compared to mathematical and regression methods of modeling.

The fabric data bank consisted of fibre, yarn and fabric constructional details with corresponding low stress mechanical and dimensional properties using FAST set of instruments, for 240 wool and wool-blended suiting fabrics, and 96 polyester-viscose suiting fabrics, which were used to train and test the neural networks, and to search fabrics during designing.

Artificial neural networks, based on error back propagation and radial basis function learning algorithms have been compared for their ability to predict the fabric structure-property relationships.

In the first stage, which is 'forward engineering', the networks were trained to predict the fabric properties from fibre, yarn and fabric constructional parameters as inputs. In the second stage, i. e., 'reverse engineering', the neural networks were trained to prescribe desired fabric structural parameters from fabric property specifications. Both the networks were found to have high coefficient of correlation (0.98) between

the actual and predicted values. Radial basis function network was found to be superior to back propagation network, in terms of accuracy, training speed and ability to predict the trends in fabric structure-property relationships due to changes in fabric parameters.

The comparison of wool-polyester and polyester-viscose blended suiting fabrics, revealed the superiority of wool blended suiting fabrics for its good hand, mechanical comfort and appearance characteristics.

The influence of fabric finishing stages on low stress mechanical properties of wool-polyester blended suiting fabrics could be useful for finisher to control and optimize the processing parameters, and for weaver to incorporate the probable changes to take place during finishing while deciding fabric constructional parameters to achieve desired finished fabric structure and property.

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CHAPTER III

CHAPTER VIII

ARTIFICIAL NEURAL NETWORK EMBEDDED EXPERT SYSTEM FOR DESIGN OF WOVEN SUITING FABRIC