BUSITEMA UNIVERSITY

FACULTY OF ENGINEERING

DEPARTMENT OF TEXTILE AND GINNIG ENGINEERING

DISSERTATION

PREDICTING THE BREAKING STRENGTH OF A ROTOR SPUN YARN USING ANFIS

BY

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A PROJECT REPORT SUBMITTED IN PARTIAL FULFILLMENT

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OF SCIENCE IN TEXTILE ENGINEERING

ABSTRACT

This project was carried out in partial fulfillment of the requirements for the award of bachelor of science in textile engineering. In this project ANFIS was used to predict the breaking strength of a cotton rotor spun yarn. Rotor speed , twist and draft were used as input parameters for the model and strength was used as the output for the model.

Twenty eight samples of yarn were produced from twenty eight experiments carried out at Southern Range Nyanza Limited (SRNL) in Jinja Uganda. The data obtained was then used to build an ANFIS model that was tested and validated.

The report shows all the surface plots of the model, the graphs showing the prediction performance of ANFIS and linear regression, membership function plots, the data used and the codes that were used in this research project.

The report also explains the detail of model development and validation, how the membership function types were chosen, which problem is being solved, the objectives of the project and finding of researchers who did closely related work. The report shows all the findings and recommendations of the project.

DEDICATION

This piece of work is dedicated to all those who have supported me on my journey to complete this level of my education especially my parents who have worked sacrificially and tireless to ensure we attain education. Additionally I thank all my course mates for their kindness and support throughout the four years.

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First and foremost, I would like to extend my sincere gratitude to the Almighty God for His unlimited grace and love bestowed upon my life.

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Special thanks go to DR. Nibikora Ildephonse for his continued guidance to ensure that this exercise is successful.

Last but undoubtedly not least, I would also like to express my appreciation to my friends and colleagues for the moral and physical support given to me in my endeavors to complete this piece of work.

The Almighty God bless you abundantly.

DECLARATION

I hereby declare that this piece of work is my own original work and has never been submitted wholly or partially to any University or institution of higher learning for any award whatsoever.

Signature: ----------

MIYINGO STEVEN

Date: 12/06/2014

APPROVAL

This is to certify that I Miyingo Steven registration number, BU/UG/2010/125 a fourth year student offering Bachelor of Science in Textile Engineering in the Faculty of Engineering at Busitema University, has carried out the project mentioned above.

Main supervisor

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Eng.Rwahiire Samson.

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GLOSSARY OF SYMBOLS AND ACRONYMS

ANN	Artificial Neural Networks.
AFIS	Advanced Fiber Information System
AI	Artificial Intelligence
ANFIS	Adaptive Neuro-Fuzzy inference system
ED	Experiment Design
FIS	Fuzzy Inference System
GUI	Graphical User Interface
HVI	High Volume Instrument
LSE	Least Square Estimate
MF	Membership Function
MIQ	Machine Intelligence quotient
MSE	Mean Square Error
RMSE	Root Mean Square Error
SSE	Sum Squared Error
R^2	Correlation coefficient

CHAPTER ONE

1.0 Introduction.

This chapter includes description of the spinning processes that's rotor spinning, yarn strength, brief description of soft computing techniques, the problem being solved and the objectives to be achieved in this project.

1.1 Background

Variation of yarn parameters such as diameter, mass, twist, strength etc. is unavoidable, especially for staple yarns, but this situation is not desired in most cases because it affects the quality of the fabric by leading to faults like mispicks, missing ends.

Variation of yarn characteristics can cause problems, both during the production processes and after production leading to poor quality fabrics. So, the relationships between these characteristics must be clearly established in order for precautions to be under taken and various problems avoided.

Yarn strength is the most important of many yarn parameters, it is in most cases used as a quality parameter of a yarn. Therefore, establishing the relationship between yarn strength and other yarn parameters and estimating the yarn strength is of considerable importance for both practical and theoretical works. In this research, we aim to predict the strength of the rotor spun yarn by using adaptive neural fuzzy inference systems (ANFIS).

This model offers ability to estimate the yarn strength as its neural network based counterpart but provides an additional level of transparency that neural networks fails to provide. Comparing to the neural networks, the fuzzy inference system mainly consists of membership functions, fuzzy logic operators, and prescribed if–then rules as described in the literatures. Measuring the factors that directly affect the strength of the yarn such as yarn evenness, twist per inch, yarn count with respect to those set on the rotor frame, this system can be used to predict the strength of the yarn.

In textile mills ANFIS is used to predict quality parameters that are nonlinear like strength transfer efficiency of warp and weft yarns in woven fabrics, yarn properties like strength, dyeing

REFERENCES

1. Dayik, M.; Prediction of Yarn Properties Using Evaluation Programming; Textile Research Journal 2009, 79, 963-972.

2. Sette, S.; Boullart, L.; Langenhove, A. V.; Kiekens, P.; Optimizing the Fibre-to-Yarn Production Process with a Combined Neural Network/Genetic Algorithm Approach; Textile Research Journal 1997, 67, 84-92.

3.Beltran, R.; Wang, L.; Wang, X.; Predicting Worsted Spinning Performance with an Artificial Neural Network Model; Textile Research Journal 2004, 74, 757-763.

4. Nasiri, M.; Shanbeh, M.; Tavanai, H.; Comparison Statistical Regression, Fuzzy Regression and Artificial Neural Network Modeling Methodologies in Polyester Dying, Proceeding of International Conference on Computational intelligence for Modelling, Control and Automation, Austria, IEEE Computer Society, Vienna., 2005.

5.Motivate weaving and knitting technology by A.wynne

6. Erol, R.; Sagbas, A.; Multiple Response Optimization of the Staple-Yarn Production Process for Hairiness, Strength and Cost; Fibres and Textiles in Eastern Europe 2009
s refer to this model to come up with optimum parameters.

7. A. Majumdar, Application of an adaptive Neuro-fuzzy system for the prediction of cotton yarn

strength from HVI fiber properties, J. Textile Institute, Volume 96, 2005, pages 55-60, issue 1.

8. Wang K.F. & Zeng Y, 2008, AWavelet Neural Network Applied to Textile Spinning, Aspects of

Mathematical Modeling, Mathematics, and Biosciences in Interaction, pp. 363-369.

9. Cheng K.P.S. & Lam H.L.I., 2003,. Evaluating and Comparing the Physical Properties of

Spliced Yarns by Regression and Neural Network Techniques, Text. Res. J., 73(2), pp 161-164.

10. Lewandowski S. & Drobina R, 2008, . Prediction of Properties of Unknotted Spliced Ends of

Yarns Using Multiple Regression and Artificial Neural Networks, Part II: Verification of Regression Models, Fiber & Text. In East. Eur., 16,6 (71) pp. 20-27.

11. Ke-Zhang Chen, Cun-Zhu Huang, Shang-Xian Chen and Ning Pan, Developing a New Drafting System for Ring Spinning Machines, Textile Research Journal 2000; 70; 154

12. N. A. Kotb, Predicting Yarn Quality Performance Based on Fibers types and Yarn Structure, Life Science Journal 2012;9(3)

13. Dr Assad Farooq[15] and Muhammad Rizwan shakir, Linear regression Analysis of Yarn characteristics by using the spinning parameters; TEXtalks, November/December 2012

14. Trommer G, 'Rotor Spinning', Deutscher Fachverlang, Frankfurt/Main, Germany, 1995.

15. Cizek L, Supervision of the BD 200 Spinning machine, cited in "Open-end spinning" (Elsevier scientific publishing company, New York) 1975, 319

16. Saxena A K, Internal and surface structure of rotor-spun yarn, Ph.D. thesis, IIT –Delhi, 1991.

17. Ishtiaqe S M & Saxena A K, Indian J Fibre Text Res, 23 (1998) 209.