BUSITEMA UNIVERSITY

Pursuing Excellence

FACULTY OF ENGINEERING

DEPARTMENT OF TEXTILE AND GINNING ENGINEERING

PREDICTING FABRIC WEIGHT PER UNIT AREA OF KNITTED STRUCTURE USING FUZZY LOGIC SYSTEMS

BY

ABAHO VICENT

BU/UG/2011/130

abahovicent@gmail.com

A Research Project Submitted to the Department of Textile and Ginning Engineering in Partial Fulfillment of the Requirement for the Award of a Degree of Bachelor of Science in Textile Engineering of Busitema University

MAY 2015

DECLARATION

I ABAHO VICENT, hereby declare that each piece of information presented in this project is my own work and that to the best of my knowledge has never been sub mitted by any other person to any institution for an academic award of any kind. The content of this report is the result of research which has been carried out from different sources between the period of September and December 2015

Signature ..... date 01/07/2015

APPROVAL

I hereby do present this project report for approval as supervised for which it's being written. This is to certify that ABAHO VICENT registration number, BU/UG/2011/130 a 4th year student offering Bachelor of Science in Textile Engineering in the Faculty of Engineering at Busitema University, carried out the fore mentioned project.

Dr. Nibikora Ildephonse

Sign..... Date.....

ACKNOWLEDGEMENT.

First of all, I thank the almighty God for the gift of life and for the knowledge and courage that has enabled me complete my project. Special thanks go to my supervisors, Dr. Nibikora Iidephonse, for his tireless expert guidance, continuous advice, and encouragement offered to me throughout the whole process of preparation of this research project. Thanks also go to Busitema University Ginning and Textile Engineering Department, not forgetting Dr. Nibikora Ildephonse who is the head of the department, for all the guidance and ideas rendered to me by Dr. Nibikora Iidiphonse during identification of the research topic and preparation project. Lastly, I thank, all my friends for the ideas shared and all kinds of support rendered during identification of the project topic and during the preparation of the project. May the almighty God reward you.

DEDICATION

I dedicate this final year project report to all the people that have laid a hand in helping me throughout the compilation of this report.

ABSTRACT

The main purpose of this study is to develop a fuzzy model for the prediction of fabric GSM of cotton knitted fabrics as a function of yarn count and knitting stitch length. The most significant key factors yarn count and knitting stitch length affect the GSM of cotton knitted fabrics are very non-linear. Hence, developing a prediction model by using mathematical or statistical approach is very difficult task. Conversely, artificial neural network and neural-fuzzy models are trained using vast amounts of experimental data which are also time consuming process. Fuzzy logic (FL) methodology on the other hand, is a promising modeling tool which performs extraordinarily very robust in a non-linear complex field with least trial data. The prediction model was found to be valid by correlation analysis. The mean relative error, correlation coefficient and goodness of fit from the predicted values were found to be 4.56%, 0.995 and 0.999 respectively. The results show very good performance of the prediction model.

ACRONYMS

ANFIS= Adaptive Neuro-Fuzzy Inference System

ANN =Artificial Neural Networks

GUI=Graphical User Interface

FIS =Fuzzy Inference System

ASTM =American Standard Testing Methods

BS=British Standard

GSM=Grams per Square Metre

MF=Membership Function

RMSE= Root mean square error.

MSE=Mean Square Error

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND

Knitting is a process of fabric manufacturing by interlocking series of loops of one or more yarns. Prediction of knitted fabrics properties is one of the most fascinating topics in the knit textile manufacturing due to the increasing demand of diversified product quality and costing. Recently, the demand of knitwear items especially cotton knitwear's like T-shirts, shirts, sweaters, blouses, underwear, casual wear, active wear and sportswear have increased rapidly due exclusive quality characteristics such as elasticity, drape, wrinkle resistance, softness and high comfort compare to woven fabric (*Ertugrul andUcar,2000).*

Knitting can be stated as a complex dynamic technological process. During the knitting process, yarn is exposed to tension; therefore the fabric is in a deformed state. The relaxation process starts after taking the fabric from the machine, which causes a change in the dimensions of knitted fabrics. Dimensional changes in knitted fabrics occur during the actual knitting process as well as in the process of dry and wet relaxation. Fabric shrinkage is a serious problem for knitwear, originating from dimensional changes in the fabric, particularly in the stitches (Doyle,1953).

The Fabric GSM however, is one of the most important physical properties among all the qualities of cotton knitted fabrics. Basically, GSM (gm/m2) is the weight per unit area of fabrics and GSM is directly related to the fabric weight. For readymade garments, costing of a garment depends on the fabrics weight or fabrics GSM (*Shaikh et al,2012*).The present textile knitting industry is facing tremendous challenge, due to the short life cycle of product development, increasing product diversity, high demand of product quality as well as product costing in

REFERENCES

1. Bahadir M. C.,Bahadir S. K. and Kalaoglu F., "An Artificial Neural Network Model for Prediction of Bursting Strength of Knitted Fabrics", IMLCS' 2012, PP.167-170.

2. Majumdar A. and Ghosh A., "Yarn Strenghth Modeling Using Fuzzy Expert System", Journal of Engineered Fibers and Fabrics, 2008,Vol. 3, No. 4, pp. 61-68.

3. Carman K., "Prediction of soil compaction under pneumatic tires using a fuzzy logic approach", Journal of Terramechanics, 2008, Vol. 45: pp. 103-108.

4. Tompkins, F., Science of Knitting, Wiley, New York, 1914.

5. Munden, D. L., J. Textile Inst. 50, T448-T471 (1959).

6. Chamberlain, J., 'Hosiery Yarns and Fabrics', City of Leicester, College of Technology, 1949, Vol. II, pp.106-108.

7. Charnock, I. L. A., Yarn Quality for Knitting. Text.Inst. And Ind., (1977), 15(5),175–7

8. Customization of Starfish Technology in the Production of Cotton-Knit Fabrics: A Practical Approach by A.K.M. Mobarok Hossain and Dr.A.B.M. ZohrulKabir.

9. Doyle P J, (1953).Fundamental aspects of the design of knitted fabrics, Journal Text. Inst, 44,561-573.

10. Engelhard, O., Warp versus Weft Knitting, Hos. Trade J., (Aug. 1967), 92–5.

11. H. Esen, M. Inalli, A.R Sengur, M. Esen. "Predicting Performance of a Ground Source Heat Pump System using Fuzzy Weighted Pre-Processing-Based ANFIS". Building and Environment, 43(12), pp. 2178-2187, 2008.

12. Hills R L (1989), William Lee and His Knitting Machine, Journal of Textile Institute, 80, 169–184

13. Knapton J J F et al, (1968).The dimensional properties of knitted wool fabrics part 1: The plain knitted structures, Textile 7. International Journal of Engineering & Technology I JEIJENS Vol: 11 No: 01

14. J.-S. R. Jang. "ANFIS: Adaptive-Network-based Fuzzy Inference Systems". IEE Transaction on Systems, Man and Cybernetics 23(3), pp. 665-685, 1993.

15. Jiang Tao et al, (1997).Effects of yarn and fabric construction on spirality of cotton single jersey fabrics, Textile research Journal, 67(1), 57-68.

16. Karba, M., Gersak, J., Stjepanovic, Z., The Influence of Knitting Parameters on Dimensional Changes of Knitted Fabrics in the Process of Relaxation, Proc. 2nd research Journal, October, 999-1012

17. Lehmann, E. L. Casella, George (1998). Theory of Point Estimation (2ndEdition.).New York: Springer. ISBN 0-387-98502-6. MR1639875.

18. Majumdar A, Majumdar P K &Sarkar B, J Text Inst, 96(2005) 55

19. Majumdar A, Majumdar P K &SarkarB,Indian J Fibre Text Res, 30(2005) 19

20. Moon Won Suh, (1967).A study of the shrinkage of plain cotton fabric based on the structural changes of the loop geometry due to yarn swelling and des welling, Textile