Proceedings of the 7th International Conference on Mechanics and Materials in Design,
Albufeira/Portugal 11-15 June 2017. Editors J.F. Silva Gomes and S.A. Meguid.
Publ. INEGI/FEUP (2017)

PAPER REF: 6646

STUDY OF THREAD TENSION SETTINGS FOR SHIRT MANUFACTURE USING AN INSTRUMENTED LOCKSTICH SEWING MACHINE

Patricia Mellero[1], Helder Carvalho[2(*)], Sandra Biégas[1], Fernando Nunes Ferreira[2]

[1]Universidade Tecnológica Federal do Paraná - UTFPR - Campus de Apucarana - Paraná, Brazil
[2]Dept of Textile Engineering, School of Engineering, University of Minho, 4800-058 Guimarães, Portugal
[(*)]*Email:* helder@det.uminho.pt

ABSTRACT

Textile materials are very difficult to handle and process. In the sewing industry, most processes rely on human hand, being extremely difficult to automate. The relations between material properties, machine configuration and adjustment and the resulting process parameters are also very complex. In this work, an instrumented lockstitch sewing machine is used to study the variation of thread tensions during high-speed sewing of shirts. The objective is to shed light on the principles that may allow for an automatic setting of the machines depending on sewn materials, besides providing tools for real-time process control.

Keywords: sewing, thread tensions, lockstitch, garment manufacturing.

INTRODUCTION

Garment manufacturing or, in general, the processing of textile products by sewing them together, is a very complicated process. This fact is not obvious at first glance, but a closer look at the process reveals that, due to the flexible, often extensible nature of the materials, their handling is a procedure that in almost all cases requires human hand. Furthermore, setting the machines for the huge variety of materials used is another task only accomplished by experienced sewing technicians. Machine configuration and adjustment is an empirical, time-consuming process that represents significant time considering that textile industry has been constantly moving away from mass-production to small orders with varying materials and styles. Ideally, machines should be able to set themselves up when fed with data regarding the material properties and desired process parameters. They should also be able to adapt themselves during operation and detect defects and malfunction automatically.

This research has been carried out by several researchers, like Stylios (1996) who set down the principles of intelligent sewing machines. Within our research team, previous research has been carried out on thread tensions, material feeding and needle penetration forces in overlock machines (Carvalho, 2008). This paper describes current work on the behaviour of thread tensions in an industrial lockstitch sewing machine.

EXPERIMENTAL WORK

An industrial PFAFF 1053 lockstitch machine has been instrumented with a thread tension sensor plugged to a signal conditioning circuit which in turn connects to a National Instruments PCI-MIO-16E-1 data acquisition board (although known as thread tension, the

parameter measured is actually a thread pulling force). A software application has been developed in Labview allowing the acquisition and processing of the resulting signals.

Thread tension is imposed to sewing threads by a device called a tensioner. This device consists of two disks between which the thread passes. A spring holds the two disks together, the pre-tension of this spring can be adjusted and is called in this context static thread tension.

In the current experimentation, thread tension waveforms throughout the stitch cycle are being analysed with varying parameters such as: Static thread tension adjustment, number of fabric layers, mass per unit area and thickness of fabric, needle size and sewing speed. A typical sewing waveform of thread tension in one cycle is represented in Fig. 1.

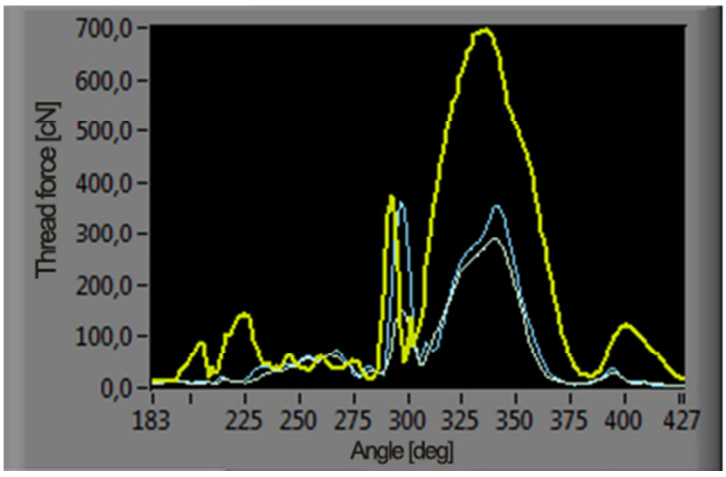

Fig. 1 - Thread tension over one stitch cycle with low, normal and high static thread tension adjustment. Amplitude of main peak reflects the adjustment

It has been found that most of the signal processing results match the expected behaviour, although some aspects have to be studied in further detail and can provide clues to an understanding of the principles of automatic set-up and control. Detailed results and conclusions will be presented in the full paper.

ACKNOWLEDGMENTS

This work is financed by FEDER funds through the Competitivity Factors Operational Programme - COMPETE and by national funds through FCT - Foundation for Science and Technology within the scope of the project POCI-01-0145-FEDER-007136

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