



MAINTENANCE PLANNING OF THE SEWING NEEDLES OF SIMPLE SEWING MACHINES

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Abstract: *The effectiveness of simple sewing machines can be increased through the planning of predictive maintenance activities. The monitoring of the technical condition of the sewing needles of simple sewing machines was based on the measurement of their noise level. For this purpose a Center 322 sonometer was used, while the data obtained during the monitoring process was analyzed through the E322 software. The working speed of the simple sewing machine that was used for obtaining the experimental results varied from 200 stitches/minute to 4000 stitches/minute. The noise levels of a new needle at the working speed of 200 stitches/minute and 4000 stitches/minute were measured. The noise levels for a fault needle at the same working speed of 200 stitches/minute, respectively 4000 stitches/minute were also measured. Using Fuzzy Logic Toolbox™ module of Matlab®, a decision-making system for determining when replacement of the sewing needles of simple sewing machines should be performed was developed. A case study illustrates the employment of the decision-making system based on fuzzy logic for a simple sewing machine. By replacing the sewing needles of simple sewing machines at the time specified through the decision-making system based on fuzzy logic, the occurrence of the failure can be prevented and the quality of textile products can be improved.*

Key words: *Maintenance, fuzzy, wear, Matlab, sewing machines.*

1. INTRODUCTION

In the case of simple sewing machines, vibrations [1-5] and temperature [6] are among the main factors that negatively influence the function of such equipment. The wear is a phenomenon that appears in the case of moving components, while the abrasive wear influences the technical condition of the components of textile equipment [7].

The wear of sewing needles of simple sewing machines is manifested through the changing of the needles dimensions and their bending. The wear of sewing needles conducts to a nonconforming stitch, which influences the quality of products manufactured with simple sewing machines. The wear of sewing needles also increases the noise level during the technological process of sewing textile products.

In practice, depending on the characteristics of sewing material an optimum operating regime of the simple sewing machines is required. Optimal regime of the simple sewing machines is

determined so that the productivity of the sewing technological process is increased, but at the same time the quality of manufactured products is assured.

2. THE EXPERIMENTAL PART

For a simple sewing machine the maximum level of noise of the sewing needles during the sewing process was measured using a Center 322 sonometer (Figure 1).



Fig. 1: The measurement of the level of noise of sewing needles for a simple sewing machine

The sonometer was calibrated before performing the sound measurement, while for the analysis and graphical representation of data the E322 software was used. The sewing material was denim and the needles Nm 100/16 were used. The sewing machine operating mode was from 200 stitches/minute up to 4000 stitches/minute. For the working speed of a simple sewing machine of 200 stitches/minute, measurements were performed for a fault needle (Figure 2) and for a new needle (Figure 3).

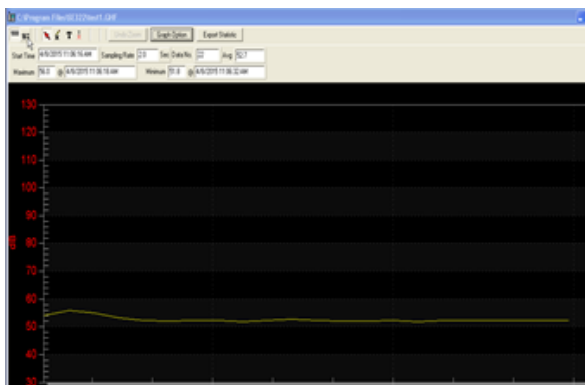


Fig. 2: The maximum level of noise of a fault needle of simple sewing machine (working speed of 200 stitches/minute)

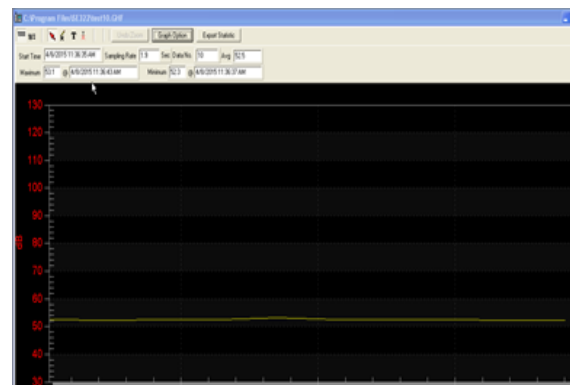


Fig. 3: The maximum level of noise of a new needle of simple sewing machine (working speed of 200 stitches/minute)

For the working speed of a simple sewing machine of 4000 stitches/minute, measurements

were also performed for a fault needle (Figure 4) and for a new needle (Figure 5).

In the case of a fault needle the noise levels was obtained between 56-82.5 db, while for a new needle the noise levels resulted between 53.1-81.5 dB. The Fuzzy Logic Toolbox™ module of MATLAB was employed to develop a decision-making system to determine the time of replacement the sewing needles of simple sewing machines.

The inference rules of the decision-making system based on fuzzy logic for determining when replacement of the sewing needles of simple sewing machines should be performed are shown in (Figure 6).

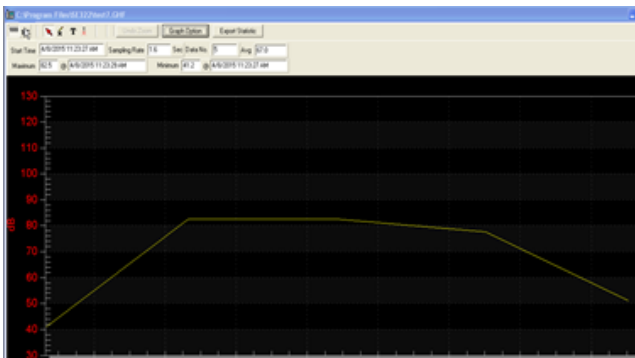


Fig. 4: The maximum level of noise of a fault needle of simple sewing machine (working speed of 4000 stitches/minute)

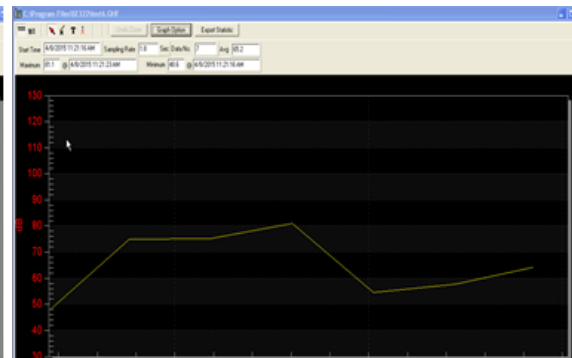


Fig.5: The maximum level of noise of a new needle of simple sewing machine (working speed of 4000 stitches/minute)

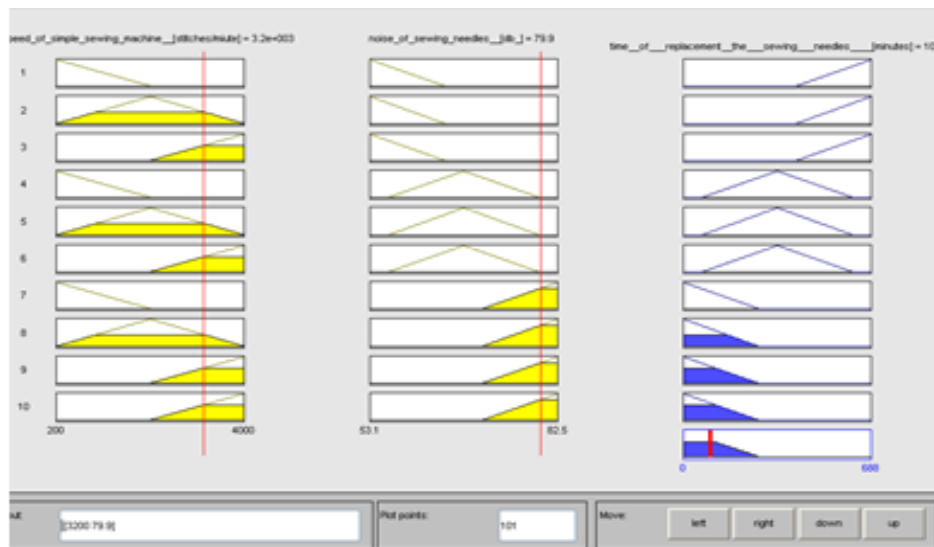


Fig. 6: The inference rules of the fuzzy decision making based on a fuzzy logic approach to determine when replacement of the sewing needles of simple sewing machines should be performed

3. INTERPRETATION OF RESULTS

If the working speed of simple sewing machine is = 3200 stitches/minute and the noise of sewing needles of sewing is=79,9 db, then from figure 6 the time of replacement the sewing needles of simple sewing machine results equal to 101 minutes. Therefore, the replacement of the sewing



needles of simple sewing machine should be carried out after 101 minutes.

4. CONCLUSIONS

In this work, a decision-making system based on fuzzy logic for determining when replacement of the sewing needles of simple sewing machines should be performed it was developed, depending on the operating speed of the sewing machine and the noise of sewing needles. The Fuzzy Logic Toolbox™ module of MATLAB was used to develop the decision-making system and its effectiveness was shown through an example.

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