Fişa suspiciunii de plagiat / Sheet of plagiarism's suspicion	Indexat la: 0107/06

Opera suspicionată (OS)	Opera autentică (OA)
Suspicious work	Authentic work

OS	ZICHIL, V. A Tool worn-out and breakage detection system using the vibration monitoring. *Modelling and Optimization in the Machines Building* Field (MOCM). no.6. 2000. 241-246.
OA	CHEN. J.C. and CHEN, W.L. A tool breakage detection system using an acceleromenter sensor. *Journal of Intelligent Manifacturing*. No.10. 1999. 187-197.

Incidența minimă a suspiciunii / Minimum incidence of suspicion	
p.241a: 01- p.241a: 06	p.187a:01 - p.187a: 06
p.241:02s - p.241:05d	p.187:18s - p.187:01d
p.241:05 – p.241:11	p.187a:06-p.187a: 11
p.246:18 – p.246:19	p.196:05s – p.196:10

A TOOL WORN-OUT AND BREAKAGE DETECTION SYSTEM USING THE VIBRATION MONITORING

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Abstract: An on-line and in-process based monitoring system to detect tool breakage via an accelerometer was developed and successfully evaluated in an end milling operation. Prior to testing and evaluation of the tool breakage condition, a simulation model was developed. Transfer of the on-line vibration signal to the frequency domain employed the fast Fourier transfer function, and set thresholds were used to determine the tool condition after various experimental tests.

Keywords: End milling operations, accelerometer, tool breakage detection

1. INTRODUCTION

With the use of tool breakage detection in machine tools, on is able to increase machine tool life, to avoid autovibrations in milling process, to avoid unexpectedly tool break-out and utilize the manufacturing environment fully. In the absence of a tool monitoring system, automation of such a process would be impossible. Experimental set-up can be divided in two parts: hardware and software. In comparison to other in process methods, such as those that employ dynamometers and acoustic emission sensors, the proposed system is easy to set up and does not require changing of the mechanism. Additional benefits of the system are its high reliability and low cost. Thus, the new monitoring system is potentially useful for untended milling operations in on-line and real-time tool worn-out and breakage detection in linked-cell manufacturing systems.

2. EXPERIMENTAL SET-UP AND RESULTS

Hardware part is composed – as shown in figure 2.1. – of an accelerometer characterized by a sensitive smaller as $5mV/ms^{-2}$, a PC computer whith an analog impute board type AX5210-PG, an oscilloscope, a video camera and a vibrometer type N 2103. Tests was made upon a fully automatic lathe, type Mazak (fig. 2.2.).

Figure 2.3. provides a diagram of the experimental set-up, using a new tool, in normal working conditions. Based on this diagram, considered correctly from the point-of view of milling process, a conclusion was possible. All tests that was driving through this process, by changing the milling parameters, has to obtain the diagram for each typically process. That's why, the author forward presents a succession of diagrams obtained for different milling conditions. The diagrams are presented in the

order that was obtained, using different row materials, starting whith soft steel, and ending whith hard steel.

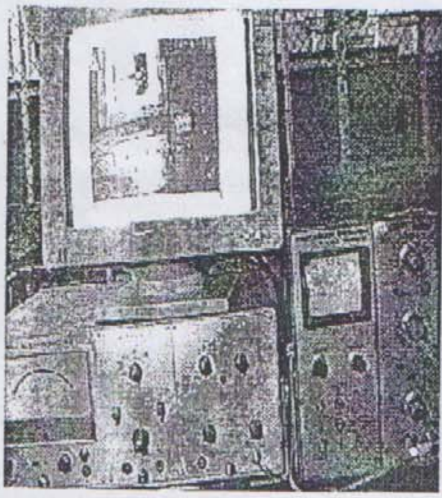

Fig. 2.1.

Fig. 2.2.

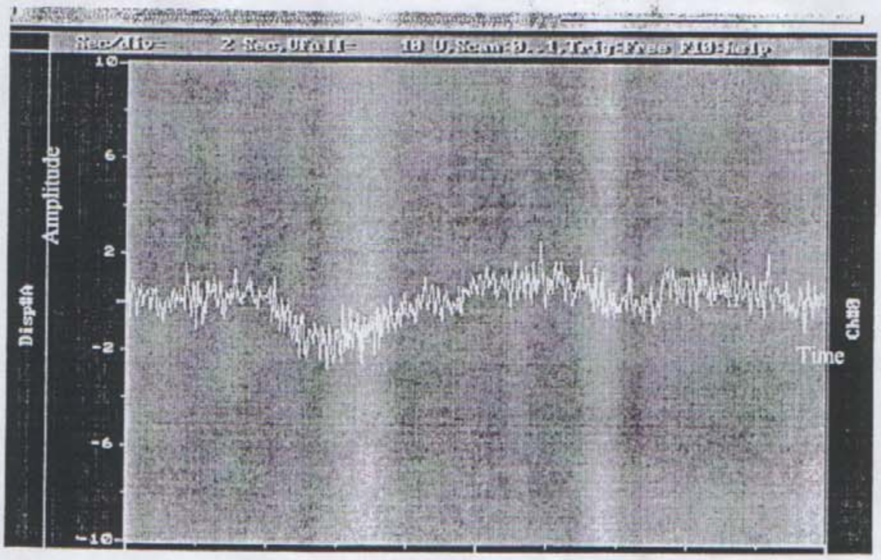

Fig. 2.3.

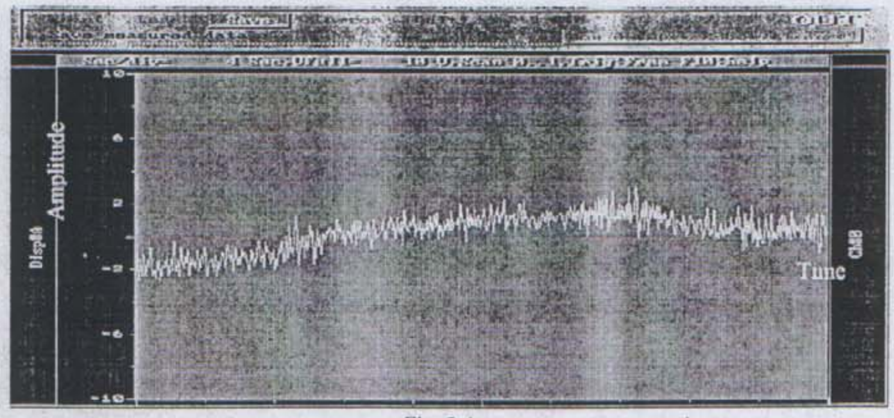

Fig. 2.4.

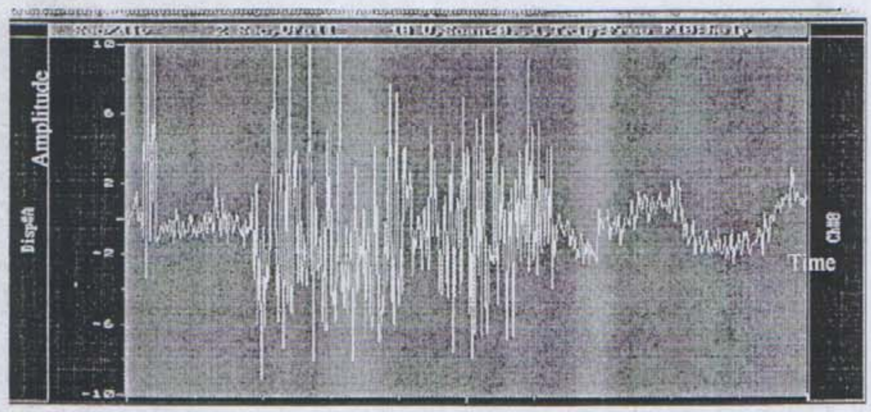

Fig. 2.5.

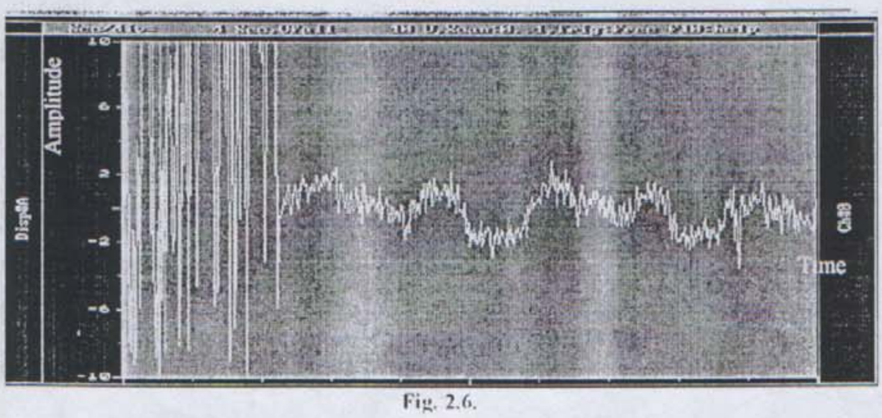

Fig. 2.6.

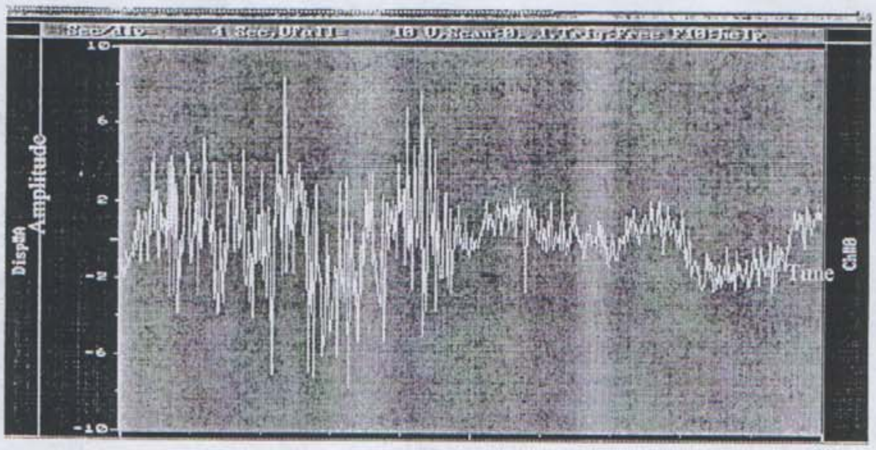

Fig. 2.7.

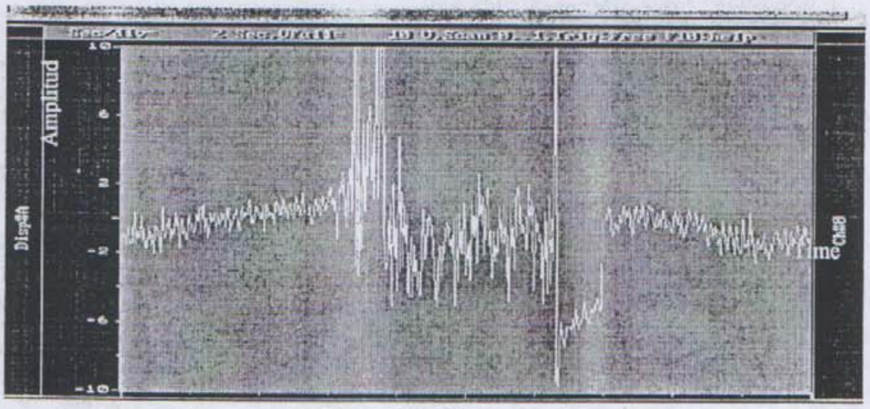

Fig. 2.8.

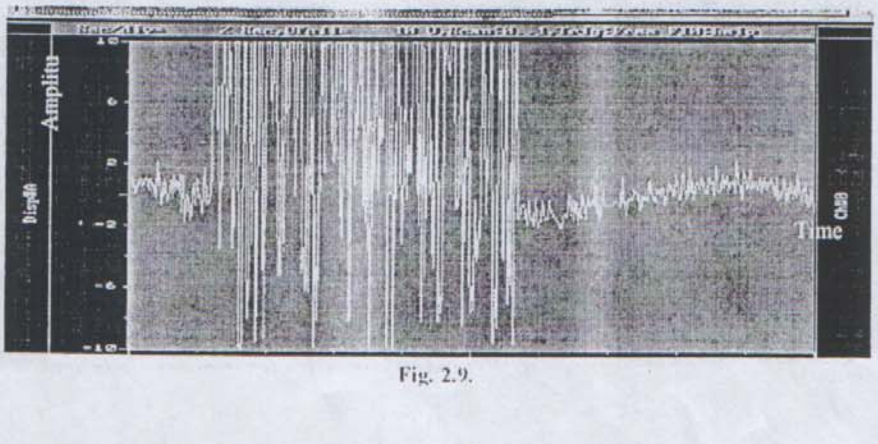

Fig. 2.9.

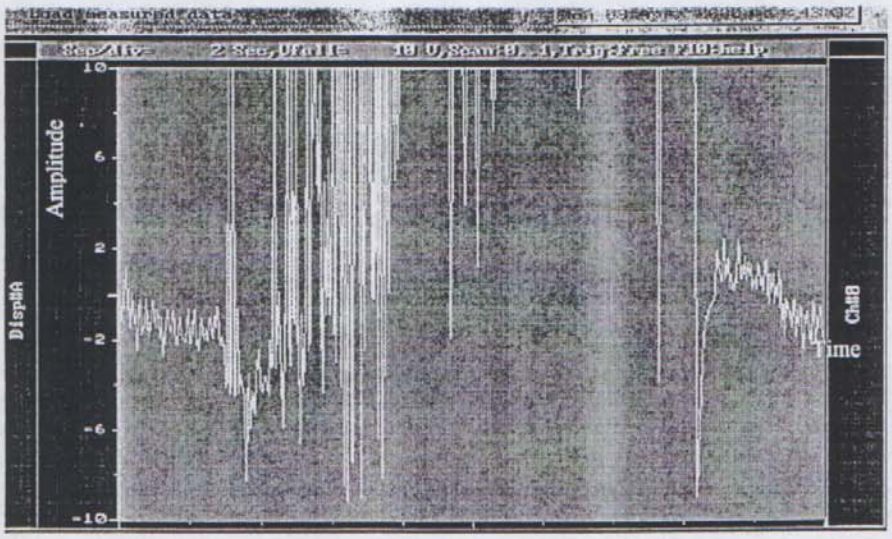

Fig. 2.10.

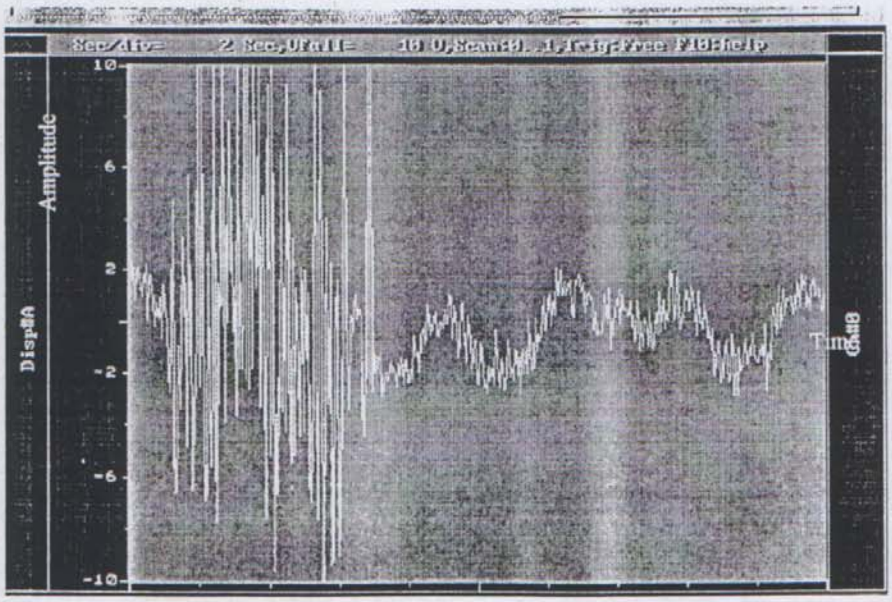

Fig. 2.11.

The figures have the following explanation:

Fig. 2.4. - milling process using a damaged tool;
Fig. 2.5. - milling process using a damaged tool, working with high feed;
Fig. 2.6. - milling process using a damaged tool, working with small feed;
Fig. 2.7. - milling process using a 10 hours used tool;
Fig. 2.8. - breaked-out tool; any unhomogenousness of the material is very hard received
Fig. 2.9. - breaked-out tool, working with high feed;
Fig. 2.10. - start milling process in a soft steel;
Fig. 2.11. - start milling process in hard steel.

3. CONCLUSIONS AND LIMITATIONS

The experimental results show that the proposed method gives an easy way of comprising the level of vibration during the milling process. Testing the process, after 10 hours of function using the same tool, offers the first degree of approaching. After this first test, varying with the row material, new tests has to be made, so we can appreciate the optimal moment of tool changing, as way as the costs of reconditioning to be as small as possible is.

The technique cannot measure tool breakage where chatter vibrations are present. When this happens, the cutting tool removes different size chips for each cut.

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