INFLUENCE OF ABRASIVE LINENESS CHANGE ON WATER JET TECHNOLOGIC HEAD OF VIBRATIONS ORIGIN

STANISLAV FABIAN[1]

Abstract: Kind and lineness of the abrasive rank among the important technological parameters influencing the surface quality at distributing through the technology AWJ. This contribution busies with the research of the kind and lineness influence on water jet technological head of vibrations origin with technology AWJ at distributing the steel S335JR (11523).

Key words: abrasive, lineness of the abrasive, vibrations, water jet

1. OBJECT AND CONDITIONS OF THE EXPERIMENT

The influence of kind and lineness change of abrasive on water jet technologic head of vibrations origin. The greatness of vibrations was judged by two parameters of vibrations the amplitude of vibrations accelerations and frequency of vibrations. The measurements were repeated at the chosen kinds of abrasive with the lineness (Barton – mesh 50, Indian garnet – mesh 80, Australian garnet – mesh 120).

The experiments were performed at Pracoviště kapalinového paprsku (Working – place of liquid jet) IF VŠB TU in Ostrava.

In table 1 the conditions in those the experiments were realized, are introduced.

2. THE DEVICES USED FOR MEASUREMENT, WORKING AND EVALUATION OF SIGNALS

For measurement of vibrations the miniature piezoelectric accelerometer from firm Brüel & Kjaer (type 4507-B-004 parameters IEPE, TEDS, 1-axis, 100 mV/g $^{-1}$) that was snapped by bee wax on the technological head of the water jet.

[1] *Technical University of Košice, Faculty of Manufacturing Technologies, Department of Technological System Operation, Prešov, Slovakia, stanislav.fabian@tuke.sk*

Table 1. **Review of the conditions at those the measurements were realized**

Pump pressure	380 MPa
Mass flow of abrasive	200 g/min
Distance of the technological head from the material	2-3 mm
Diameter of the water nozzle	0,25 mm
Diameter of the focus tube	1,02 mm
Thickness of the distributed material	10 mm
The distributed material	S335JR (11523)
Speed of the technological head feed	50 $mm.min^{-1}$
The kind of abrasive, the lineness of abrasive	Barton, mesh 50, Indian garnet, mesh 80, Australian garnet, mesh 120

Working and evaluation of signals was realized with the utilizing modular system (fig. 1.a), that is based on the platform CompactDAQ from National Instruments with the specialized functional module NI-9233 (fig. 1.b) for measurement of vibrations. The signals were worked in graphic programme environment LabVIEW Signal Express widened with module Sound and Vibration Toolkit that contains set of tools for evaluation of vibrations and sounds.

a. **b.**

Fig. 1. The portable modular system CompactDAQ (a) with the module NI-9233 for measurements of vibrations (b)

3. THE MEASURED DATA

Fig. 2 represents the digital record of the analogous output of the sensor in volts that was recalibrated by the functional dependence on the amplitude of vibrations acceleration [g]. The time course of vibrations is evaluated with help of quick Fourier ʾs transformation as the greatness of the mean value of the acceleration amplitude of vibrations in frequency spectrum in the extent from 1-4200 Hz and as follows it is represented in the graph fig. 2B. The example of amplitude vibrations acceleration at corresponding frequency on the kind and lineness of the abrasive Barton with lineness mesh 50 is concretely represented in fig. 2B. The further dependences for the abrasive Indian garnet and Australian garnet are represented in the comparing graph (fig. 3) that was performed for the simpler and more intuitive comparing of the researched abrasives. The comparing graph of the vibrations acceleration amplitude at corresponding frequency for three researched abrasives was created so that the maximum value of vibrations acceleration amplitude for the followed lineness of abrasive was taken out for every interval with the extent of frequencies 200 Hz. The value of vibrations acceleration amplitude under 0,000025 was rounded off on 0. With the value 0,000025 was determined the boundary under that are the values of vibrations acceleration amplitude measured in the readiness state (the state when the machinery is in operation and it waits on letting down of the programme).

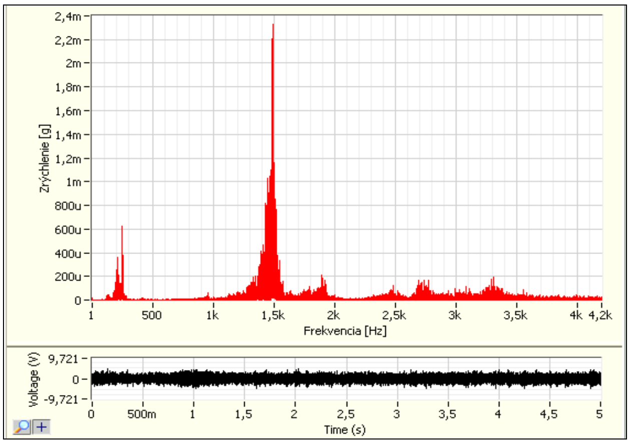

Fig. 2. Dependence of vibrations acceleration amplitude course at corresponding frequency on the lineness of abrasive mesh 50 at speed of technological head feed 50 mm min^{-1} for the steel S335 JR (11 523)

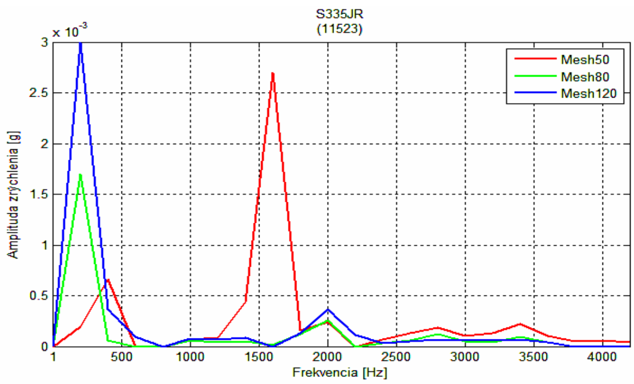

Fig. 3 Comparing graph of vibrations acceleration amplitude courses at corresponding frequency for three researched dependences of abrasive at speed of technological head feed 50 mm.min^{-1} for the steel S335JR (11 523)

4. EVALUATION AND JUDGING SIGNALS

On the basis of preceeding statings it is possible to say that the kind and lineness of abrasive have the influence on the origin and intensity of vibrations on the technological head at distributing with the technology AWJ.

5. RECOMMENDATIONS

From the measurements and evaluations it follows that for the steel S 335JR (11 523) at speed of technological head feed 50 mm min^{-1} at distributing that abrasives were used with the lineness (Barton – mesh 50, Indian garnet – mesh 80, Australian garnet – mesh 120). It is most suitably to use the abrasive Indian garnet with the lineness mesh 80 because at this abrasive the vibrations with the smallest amplitude were ascertained. The greatest vibrations were measured at using the abrasive Australian garnet with the lineness mesh 120 where the maximum value of vibrations acceleration amplitude reached the value 0,003g at the frequency about 200 Hz and at the abrasive Indian garnet with the lineness mesh 50 where the maximum value of vibrations acceleration amplitude 0,0025g at the frequency about 1500 Hz was measured and therefore we do not recommend to cut the steel 11 523 with the abrasive Australian garnet – mesh 120 and the abrasive Indian garnet – mesh 50.

6. CONCLUSION

The knowledge introduced in the contribution creat the partial part of the grant scientific project VEGA no.1/0544/08 and Institutional project 5/2010 solution. They are the part of the dissertation [3] solution an open up on the solution of dissertations realized on Department of manufacturing processes operation FVT TU in Košice with the seat in Prešov and on Working-place of liquid jet IF VŠB TU in Ostrava. The more complete results will serve on exacting physical model of water jet created on PKP IF VŠB TU in Ostrava.

REFERENCES

[1]. **Fabian S.**, *Prevádzka výrobných systémov (Operation of Manufacturing Systems)*, Prešov 2005, ISBN 987-80-8073-889-1.

[2]. **Kreidl M., Šmidl R.**, *Technická diagnostika (Technical diagnostics*), Praha 2006, ISBN 80-7300.158-6 (in Czech).

[3]. **Bičejová Ľ.**, *Modelovanie a simulácia vplyvu prevádzkových podmienok na vznik a rozsah vibrácií vo výrobných systémoch (Thesis: Modelling and simulation of operation conditions influence on origin and extend of vibrations in manufacturing systems)* FMT TU Košice with seat in Prešov, Prešov 2010.

[4]. **Fabian S., Bičejová Ľ.**, *Influence of fineness abrasive and cutting speed change on vibration formation at cutting using AWJ technology*. In: Scientific Papers: operation and diagnostics of machines and production systems operational states, Vol.2, RAM-Verlag, Lüdenscheid, pp. 88-92, 2009, ISBN 978-39802659-8-0.

[5]. **Kmec J., Bičejová Ľ.**, *Noise and vibration evaluation of water jet material cutting working surroundings,* In: Annals of Faculty of Engineering Hunedoara, Vol. 7, no. 1 (2009), pp.139-144, ISSN 1584-2665.