4.5.30. QUALITY TESTING OF BLOCK FLUTES USING NATIONAL INSTRUMENTS TECHNOLOGIES

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Block-flute has been wide-spread as one of the reasonable, individually used musical instrument. In our perception the sound of the inferior quality instrument is equivalent to noise [1].

The authors research the control of the wide-spread musical instruments, such as block-flutes and reed-pipes (fig. 1). Block-flutes and reed-pipes are the wind instruments whose sounds are influenced with the aerodynamic processes. Block flute and reed-pipe have been chosen as researched objects. The first examples (Alto and Soprano) are the handmade instruments made of fruit-tree wood. They are individually matched and tuned up to the Standard European fingering. The sound pitch is standard – 440 Hertz for the note "La".

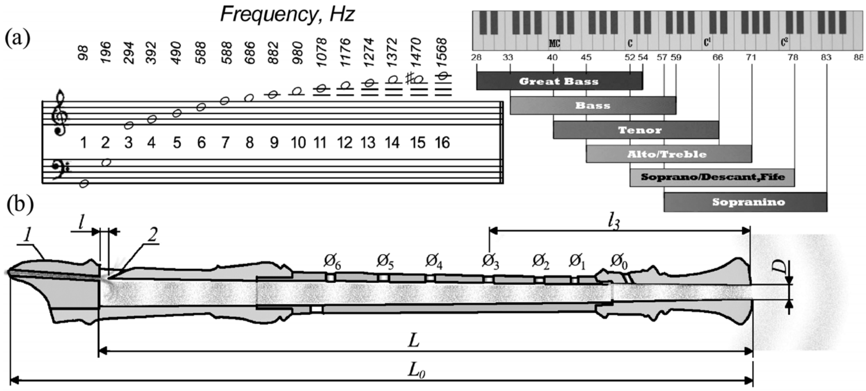


Fig. 1

The means and programme products being used (eg. Adobe Audition) do not allow to implement all kinds of acoustic analysis, to make any systematic refinement of the analysis and make remote control.

The elaborated Control Acoustic System is based both on the special equipment by National Instruments (NI) and a personal computer with a microphone. The Virtual Instrument (VI) has been made for indicating the vibration of musical instruments based on LabVEW elaborations. The Virtual Instrument allows to indicate sound vibrations of the determined duration, to do the primary analysis and save the sound track in external storage. The experimented VI has been made for analysis of the received data. It represents the parameters of the whole signal and a short marked fragment. The tipical fragments of the sound vave are represented in the table.

Signals have a periodic form with the predominance of the main harmonic component, however, there is an insignificant of the signal frequency and it's amplitude. In the nearest periods there are some changes of the signal form.

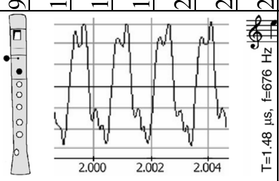
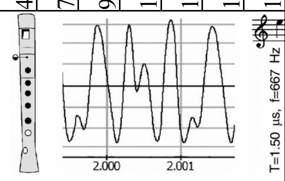
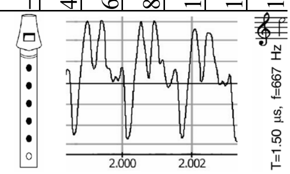
The time frequency analysis short wave has been used for the detailed analysis of the temporal instability of the sound vibrations (product by National Instruments- Signal

Processing Toolset). It has been experimentally determined, that the best results of the high-quality sound analysis of the musical instrument are provided with the Gabor spectrogram the 3rd–4th rate.

The received signals have a complicated structure of the time frequency spectrum that has close and distant rate of the frequency-temporal heterogeneity. The order in the spectrogram is closely connected with the structural peculiarity of the instrument and it's disorder-with the instrument defect. As a rule, it is connected with the fact that some surface defects are casual. The analysis of the time frequency spectrum of the musical instrument lets us determine the defects at full length of a block flute. It can be easily explained with the physical model.

The research proved a stable positive psychological effect of the sound of the high-quality instruments; it revealed the connection between the sound quality of the block flute and the respiratory system stability [2]. The principles of the instrument quality evaluation have taken shape, as well as the possibility to identify some defects of the musical instruments. The results of the research revealed the increase of the vital-saving factors of using high-quality instruments. The authors tried to establish the evaluation principles of the individual influence of playing the block flutes both on the inspiration system and the energetic condition of a person.

Table. The form of sound signals the block of flutes and reed-pipes

1. Alto							**2. Soprano**							**3. Reed-pipes**						
$L_0 = 480.0$; $L = 430.0$; $D = 18.5–19.2$							$L_0 = 335.0$; $L = 289.0$; $D = 15.3–14.6$							$L_0 = 229.0$; $L = 224.0$; $D = 10.4–13.0$						
$Ø_0$	$Ø_1$	$Ø_2$	$Ø_3$	$Ø_4$	$Ø_5$	$Ø_6$	$Ø_0$	$Ø_1$	$Ø_2$	$Ø_3$	$Ø_4$	$Ø_5$	$Ø_6$	$Ø_0$	$Ø_1$	$Ø_2$	$Ø_3$	$Ø_4$	$Ø_5$	$Ø_6$
6.0	8.5	8.5	7.0	8.0	7.5	6.0	8.5	8.5	9.5	6.0	7.5	8.0	7.0	–	6.5	7.0	5.0	7.0	7.0	3.5
l_0	l_1	l_2	l_3	l_4	l_5	l_6	l_0	l_1	l_2	l_3	l_4	l_5	l_6	l_0	l_1	l_2	l_3	l_4	l_5	l_6
91.0	126.0	158.0	190.0	225.0	255.0	285.0	47.0	78.0	98.5	125.5	146.5	164.5	186.5	–	45.0	65.0	84.0	106.0	127.5	149.5
 «Mi» 2 octave							 «Mi» 2 octave							 «Mi» 2 octave						

References:

1. **Rupert Taylor**. Noise. Second Edition. Penguins Books, Harmondsworth, Middlesex, England (1975).
2. **Goltcov V.V.** and etc., Pulse diagnostic device and method of measuring a pulse wave using this device, United States Patent number 5, 381, 797, Jan 17, 1995.