1.8.27. COMPLEX TESTING OF MUSICAL INSTRUMENT QUALITY BY VARIOUS PROBES USING COMPUTER TECHNOLOGIES OF NATIONAL INSTRUMENTS

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Serially let out musical instruments have disorder of parameters and specific features of sounding in the greater degree. Practically are absent a productive technique to make the detailed analysis of their sounding.

Acoustic quality of string tools develops of lines parts: the string mechanism, the case of the tool, an environment. The opportunity of revealing of work and the control of separate parts of the tool that demands the various quality monitoring based on gauges of the various physical nature is considered.

In work the domra has been used, and the standard of the control was the mechanical tuning fork (440 Hz). For the independent control over stages of formation of a sound, the following quality monitoring have been chosen: acoustic; vibro-acoustic; Doppler radar-tracking. For objective and independent definition of work of string system – a method Doppler the radar-locations, providing required information the control, associated with an acoustic signal a made directly varying string (fig. 1).

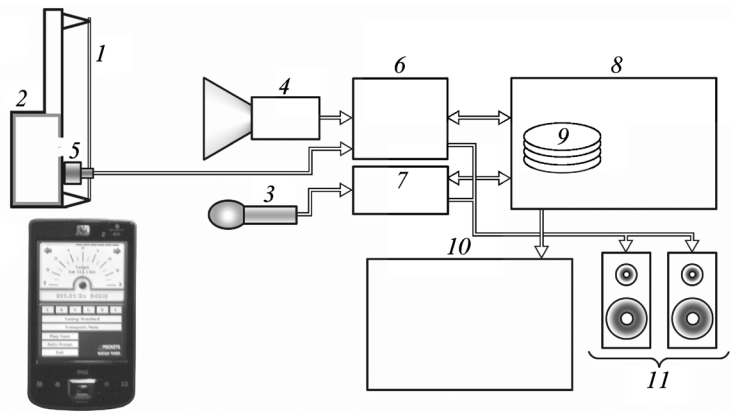


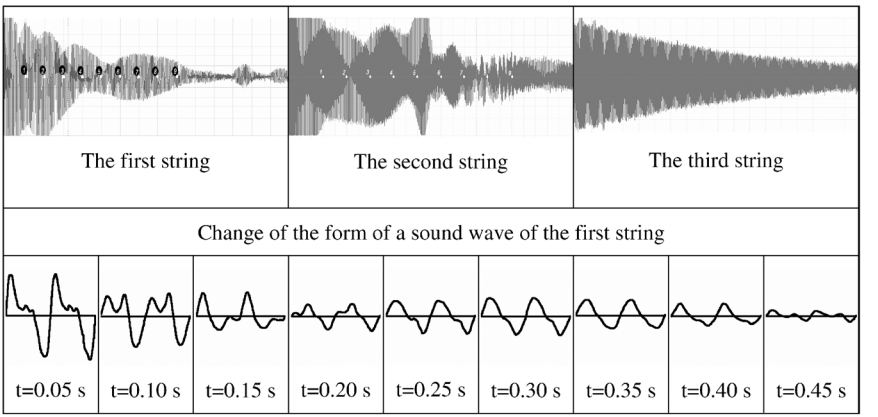
Fig. 1

As gauges in work the radar (4) with length of a wave 12 mm was used. As the gauge of a sound – microphone Philips SBC ME570 (3); vibration – sensor AP2037 (5). At construction measuring system the technology of virtual instruments (VI) of firm National Instruments (NI) has been used. As devices of data gathering (analog input, output) were used sound card Creative Professional E-MU 0202 USB (7) and hardware NI cDAQ-9172 (6): NI 9223; NI 9263; NI 9205.

For increase of efficiency it was offered to use the distributed monitoring system which was provided with use by network data transmission with help Shared Variable. Given received VI registration at the control can be analyzed by various ways others VI the project.

For a used domra for each their three strings, at the certain options of the tool, the following average frequencies of sounds are received: 1 – 314.32 Hz (D#4+17) [310.30 Hz]; 2 – 408.59 Hz (G#4-28) [405.40 Hz]; 3 – 562.34 Hz (C#5+26) [559.36 Hz]. And frequencies from a radar were higher than acoustic frequencies. The amplitude, the form and frequency of a signal smoothly varied in time (table).

Table



The form of a signal shows presence of a low-frequency component (resonant frequencies of the case of the tool). Change of the form of a signal in time (its spectrum) is determined by dependence of transfer of energy of fluctuations of a string in the case from frequency. With increase of frequency this factor falls, that determines increase in duration of sounding of high-frequency fluctuations of a string, and reduction of amplitude of a sound signal of the tool.

The sound wave from the case of the tool is influenced with factor of radiation by the case of sound fluctuations which depends on frequency and speed of formation of sound fluctuations inside the case. From the received results it is visible, that in the beginning of fluctuation of a string – frequency grows, then – falls, and, again – grows. Change of amplitude of a sound signal in time also has pulsing character. For more high-frequency sounds – the time form gets classical character.

Cases of qualitative (pleasantly sounding) tools I have a dim contour of own resonances on very low frequency. Return transfer of energy from the case withdraws frequency of a string, deducing it from own resonance that leads to reduction of amplitude. High-frequency resonances of the case are parameters of quality of the string musical instruments, resulting to pulsations of a sound, fluctuations of the frequency, unpleasant painting of sounding. While in service, transportations and storages of tools, defects of the case are sources of occurrence of high-frequency resonances.