УДК 621.314
Rengevich I.K.[1], Lushchin S.P.[2]
[1]student of group E-411a NU "Zaporizhzhia Polytechnic"
[2]PhD (Phys.-math. sciences), associate professor NU "Zaporizhzhia Polytechnic"

ANALYSIS OF PIEZOELECTRIC SPEAKER CHARACTERISTICS

Various systems of electroacoustic transducers are used to convert an electrical signal into an audio one. Today, electrodynamic transducers are used, the action of which is based on the electrodynamic effect. Piezoelectric transducers, the operation of which is based on the direct and inverse piezoelectric effect, have become widespread.

A piezoelectric sound emitter - a piezoelectric speaker consists of piezoelectric layer (or several layers), which is applied to a metal plate (membrane) up to 1.5 mm thick (Fig. 1). Lead zirconate-titonate (PZT) is used as the piezoelectric. The outside of the piezoelectric is sprayed with a metal coating. The metal plate and the metal coating are the contact pins of the piezoelectric speaker. An electrical signal is supplied to them [1].

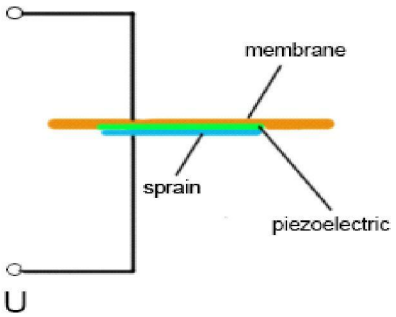

Figure 1 – Schematic of a piezoelectric speaker.

The principle of operation of the piezoelectric speaker is that when alternating voltage is applied to the contact pins, the layer of the piezoelectric is deformed, changing the distance to the membrane. A capacitor effect is formed, in which an electric charge accumulates between two metal covers. At the time of charging and discharging it emits a sound wave [1].

We investigated the characteristics of the JBL Tune 110 dynamic speaker and the Radius TWF-41 piezoelectric speaker, which are used as headphone emitters. Their main characteristics are given in Table 1:

Table 1 – Speaker characteristics

Speaker	Sensitivity	Frequency Range	Impedance
JBL Tune 110	96.0 дБ/мВт	20 Hz – 20 kHz	16 Ohm
Radius TWF-41	108±3 дБ/мВт	10 Hz – 45 kHz	32 Ohm

It should be noted that the sensitivity of the piezoelectric speaker is greater than that of the dynamic speaker. The frequency range of the piezoelectric speaker is also greater than that of the dynamic speaker.

Fig. 2 shows the amplitude-frequency characteristics for the JBL Tune 110 dynamic speaker and the Radius TWF-41 piezoelectric speaker, which were obtained using the ARTA computer program.

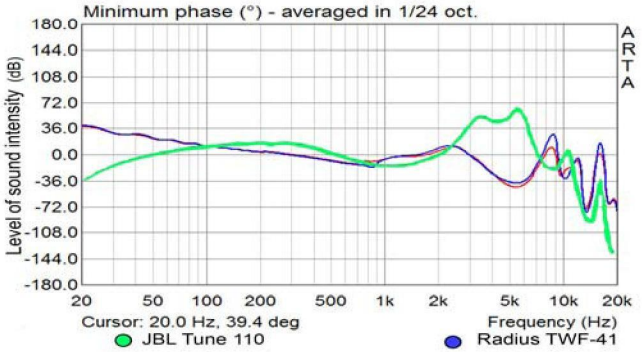

Figure 2 – Amplitude-frequency characteristics of the dynamic speaker JBL Tune 110 and piezoelectric speaker Radius TWF-41.

In the frequency range 100 Hz…2 kHz the stability of the characteristics of the piezoelectric speaker and the dynamic speaker is almost the same. The piezoelectric speaker increases the resonance around 5 kHz and reduces the sound intensity around 20 Hz. This is because the piezoelectric speaker is used for people with hearing impairments. At high frequencies, the non-uniformity of the piezoelectric speaker characteristics is greater than that of the dynamic speaker.

Thus, a comparison of the characteristics of the JBL Tune 110 dynamic speaker and the Radius TWF-41 piezoelectric speaker shows that the piezoelectric speaker has some advantages and may be more acceptable under certain conditions of use.

REFERENCES

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