

Analysis of SH-Polarized Waves Generated by Electromagnetic-Acoustic (EMA) Transducers

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Abstract. Scientists A.V. Kharitonov and A.V. Pashutin have developed new type of electromagnetic-acoustic transducers (EMAT) and proved a number of their advantages. These transducers present a set of constant magnets with alternating poles that are placed above examined surface under which placed are live conductors. As a result the specific forces are formed and particles displacement vector happens to be parallel to the surface of excitation and these are sources of mentioned generated waves.

At the same time currently not the type of generated in such a manner SH-polarized waves not the peculiarities of their excitation and propagation are investigated.

The theoretical and experimental research works revealed the fact that generated by these sources SH-polarized waves in fact are not body shear-waves but surface ones. Similar to classic Rayleigh waves, in which the medium particles are oscillating in the plane perpendicular to surface, discussed radiated waves are propagating with the velocity of the Rayleigh waves and attenuated through the depth exponentially. Though SH-polarized waves decrease considerably less while propagating from the surface into material. In fact, if the amplitude of classic Rayleigh wave reduces by 2.71 at the depth that is 10.5 times less than length of longitudinal wave in examined material the amplitude of new type wave, for the same depth, reduces only by 3.88 times. While the attenuation along examined surface for above two waves' types is the same.

In this case the excited waves' amplitude is as higher as lower is the excitation frequency. In connection with above it turns out that SH-polarized waves are mainly low frequency ones and this impose certain conditions on their application.

The structural design efficiency and ways of forming of SH-polarized wave transducers' radiation pattern are of special interest. It was found out that the greater is the number of parallel located current distributors – the higher is amplitude of radiated signal and more directional is the radiation. From the other side the increase of magnets number along the direction of sound propagation and changes of gaps between them have ambiguous impact on sound amplitude and propagation direction.