JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Reflection of Sound Waves : Application and Laws

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ABSTRACT

The law of reflection of sound waves states that the angle of incidence is always equal to the angle of reflection. But unlike reflection of light on a highly smooth surface, in the reflection of the sound wave, a part of the incident wave gets transmitted to the medium where it hits. Acoustic mirrors can reflect and focus sound waves under water, but typical mirrors require very complex configurations or geometries. Sallam et al. designed, simulated, and experimentally verified a flat acoustic mirror for underwater applications. two laws of refraction, The incident ray, the refracted ray, and the normal to the interface at the point of the incident all lie in the same plane. The ratio of the sine of the angle of incident and the sine of the angle of refraction is constant for given pair of media. Sound waves mostly reflect back from any water-air boundary, making it nearly impossible to hear underwater sounds from above. But now physicists have devised a structure that, when placed in contact with the surface, can enhance sound transmission up to 160 times, allowing 30% of the sound energy through.

Key Words : Introduction, Nature, Types, Theory, Applications and Laws

Introduction

The wave is a disturbance in a medium that carries energy without a net movement of particles. It may take the form of elastic deformation, a variation of pressure, electric or magnetic intensity, electric potential, or temperature. Waves are generally caused by the action of winds on the surface of ocean water. Winds cause the particles of the surface water of the ocean to be

pushed down. The water particles again rise above the surface. This continuous up and down motion is passed on to other surface particles and is known as wave. Waves refer to the transfer or flow of energy from one point to another without the transfer of matter. It appears in the form of oscillations when they pass through any medium or without any medium.

They are present around us in both visible and invisible forms. Some of the types of waves are radio waves, sound waves etc. An individual is completely dependent on a wide range of waves for wireless communications. When you call your friend then the entire communication on the phone happens through the transmission of waves. The communication from the sender to the receiver appears in the form of a waveform. Your phone converts the received voice signal into an electrical signal. Later, these electric signal travels either wirelessly or via copper wires to the receiver through an antennae. In this way, waves help in communication between people.

Reflection is used in mirrors, especially concave mirrors in vehicles to avoid accidents on the road. -Reflection is used in defense by radars where radars send waves which after reflection get back to radar then it can interpret technical fighter jets. For communication Sound is the only main form of communication for humans and animals. We, humans, communicate verbally with spoken languages besides body language. In comparison, the animals make sounds to communicate with each other. Sound reflection occurs when soundwaves bounce back from the surface of a solid or liquid.

Many fascinating phenomena, such as echo and reverberation, are caused by sound reflection. The reflection of sound, like the reflection of light, obeys laws. When a sound hits a hard surface, it bounces back to its source. Rainbows, atmospheric refraction, distortion of underwater objects, telescopes, and prisms are all examples of refraction in the natural world. It is caused by the bending of light as it passes through mediums. Sound Application has devoted over 30 years to designing performance power line conditioners used worldwide in ultra resolution Pro Audio and audiophile systems. With an SA power line conditioner your components unleash a natural and organic musical landscape that will take your breath away.

Nature of the Sound Waves

The sound waves are mechanical longitudinal waves that need a medium to propagate, They propagate through media as the spheres whose centre is the source of the sound, and they consist of the compressions and the rarefactions. You notice that we hear the sound from all the directions that surround the sound source because the sound travels through the air as pulses of the compressions and the rarefactions whose centre is the sound source.

-The properties of the sound waves : The sounds may be pleasant to our ears such as the music, and they may be the source of the fear such as the sound of the strong winds and the thunder.

The musical tones are the tones of uniform frequency, and comfortable to be heard, Examples: The violin, The piano, and the reed pipe.

-The source of the disturbance and the irritation such as the horns and the loudspeakers, The sounds can be classified into two groups which are the musical tones and the noise.The noise is the sound of the non-uniform frequency, and uncomfortable to be heard, Examples: The drill, The loudspeakers, and the horn of the cars.

-The sound velocity : The sound velocity is the distance that is covered by the sound waves in one second, and the sound waves propagate through the different media with different velocities.

-The sound travels through the air at a velocity of 340 m/s, and it depends on the temperature of the air, the air pressure, and the humidity in the air. The sound velocity through the solids is larger than that through the liquids, and the velocity through the liquids is larger than that through the gases.

recognizes that sound exists independently of an individual's reception. You may recognize this section from our blog post, "What is a Sound Wave in Physics?" Keep reading for a more in-depth look at sound waves.

Types of Sound

There are many different types of sound including, audible, inaudible, unpleasant, pleasant, soft, loud, noise and music. You're likely to find the sounds produced by a piano player soft, audible, and musical. And while the sound of road construction early on Saturday morning is also audible, it certainly isn't pleasant or soft. Other sounds, such as a dog whistle, are inaudible to the human ear. This is because dog whistles produce sound waves that are below the human hearing range of 20 Hz to 20,000 Hz. Waves below 20 Hz are called infrasonic waves (infrasound), while higher frequencies above 20,000 Hz are known as ultrasonic waves (ultrasound).

Ultrasonic Waves : Sound waves that have frequencies higher than 20,000 Hz produce ultrasound. Because ultrasound occurs at frequencies outside the human hearing range, it is inaudible to the human ear. Ultrasound is most often used by medical specialists who use sonograms to examine their patients' internal organs. Some lesser-known applications of ultrasound include navigation, imaging, sample mixing, communication, and testing. In nature, bats emit ultrasonic waves to locate prey and avoid obstacles.

Infrasonic Waves : Infrasonic waves have frequencies below 20 Hz, which makes them inaudible to the human ear. Scientists use infrasound to detect earthquakes and volcanic eruptions, to

map rock and petroleum formations underground, and to study activity in the human heart. Despite our inability to hear infrasound, many animals use infrasonic waves to communicate in nature. Whales, hippos, rhinos, giraffes, elephants, and alligators all use infrasound to communicate across impressive distances – sometimes hundreds of miles!

Theory of Laws of Reflection of Sound

Reflection of sound is similar to the reflection of light. The reflection of sound obeys the following laws of reflection The angle of incidence is equal to the angle of reflection. The incident sound, the normal sound and the normal sound all lie in the same plane. When a sound hits a hard surface, it reflects back to its source. This reflection of sound is otherwise is called an echo.

Hard surfaces have a tendency to reflect sound while soft surfaces absorb sound and silence them. If the frequency of the sound wave is low, then the sound wave will not get reflected. Sometimes, we hear multiple echoes from a source of sound if the area is large and has multiple reflecting surfaces such as valleys and huge empty rooms. This phenomenon is known as reverberation**.**

Reflection is the change in direction of a wavefront at an interface between two different media so that the wavefront returns into the medium from which it originated. Common examples include the reflection of light, sound and water waves. Sound propagates through air as a longitudinal wave. The speed of sound is determined by the properties of the air, and not by the frequency or amplitude of the sound.

If a sound is not absorbed or transmitted when it strikes a surface, it is reflected. The law for reflection is the same as that of light, ie., the angle of incidence of a sound wave equals the angle of reflection, just as if it were produced by a 'mirror image' of the stimulus on the opposite side of the surface.

When sound travels in a given medium, it strikes the surface of another medium and bounces back in some other direction, this phenomenon is called the reflection of sound. The waves are called the incident and reflected sound waves.

The sound waves that travel towards the reflecting surface are called the incident sound waves. The sound waves bouncing back from the reflecting surface are called reflected sound waves. For all practical purposes, the point of incidence and the point of reflection are the same point on the reflecting surface.

A perpendicular drawn on the point of incidence is called the normal. Thangle which the incident sound waves makes with the normal is called the angle of incidence, "i". The angle which the reflected sound waves makes with the normal is called the angle of reflection, "r".

The following two laws of reflection of light are applicable to sound waves as well: The incident wave, the normal to the reflecting surface and the reflected wave at the point of incidence lie in the same plane. First Law of Reflection: The incident wave, the reflected wave, and the normal at the point of incidence lie on the same plane. The angle of incidence is equal to the angle of reflection.

Applications of Reflection of Sound

The reflection is the change in the direction of a wavefront at an interface between two different media so that the wavefront returns into the medium from which it originated such as the reflection of light, sound and water waves. A few of the uses of sound reflection, as mentioned below:

Stethoscope: The stethoscope is a well-known piece of diagnostic gear. It is used to hear the position of an organ in the human body, as we all know. It likewise functions on the basis of sound reflection. With the use of the tube, the sound absorbed from the chest may be sent to the ears. Every doctor should have one of these stethoscopes. Medical practitioners regard it as a symbol.

Hearing Aid: A hearing aid is a device that people with hearing loss use to help them hear better. The hearing aid picks up the sound waves and reflects them in a smaller region heading to the ear.

Megaphones: Megaphones are the next example of sound reflection. The megaphones are horn-shaped tubes that prevent Echos and numerous reflections while speaking. All sounds can be fine-tuned and converted into tubes. These megaphones are commonly used for a variety of announcements.

Soundboards: The soundboards are concave boards with a curve shape. These are for the audience's convenience in the auditorium or seminar hall, for example. These are usually situated on the opposite side of the speakers. These sounds use the loss of reflection of sound to take the signals from the speakers and reflect them to the listener in a higher quality. This allows the audience to hear Mike more clearly, even if they are sitting far away.

Echo: The reflection of sound waves causes an echo, which is the recurrence of a sound. After the direct sound, the echo arrives with a delay at the listener. The reflection is called an echo if the time difference between the objects is more than one second. Echo is used by bats and

dolphins to locate impediments. It is also employed in the Sonar (Sound Navigation and Ranging) method, which is used to identify and locate submerged submarines and icebergs in the water.

Laws Reflection of Sound

The reflection of sound waves is governed by two laws known as the two laws of sound reflection, The first law of reflection of sound waves is the angle of incidence = the angle of reflection.The incident sound ray, the reflected sound ray and the perpendicular line from the point of incidence on the reflecting surface, all lie on the same plane, perpendicular to the reflecting surface.

-The same principle holds true for light. If we use any substance as a surface, whether it's rough, smooth, or hard water, sound flows towards the surface, half of it travels through the medium, and the other half returns to its original location. This is nothing more than a sound reflection in part.

-Sound waves that move towards a reflecting surface are known as incident sound waves whereas sound waves that return from a surface of reflection are referred to as reflected sound waves.

-Sound reflection is governed by two laws, as mentioned below: First Law of Reflection of Sound: The incidence angle and the reflection angle are always the same. and Second Law of Reflection of Sound: The incident sound is in the same plane as the reflector sound.

-Sound reflection is comparable to light reflection in that it follows the rules of reflections, where the angle of reflection equals the angle of incidence and the reflected sound, incident sound, and normal sound all reside in the same plane.

-The reflection of sound is used in many devices as the megaphones, the horns, the musical instruments like the trumpet, the shehnais, etc, The ceilings of the cinema halls and the auditoriums are curved so that the sound after multiple reflections reaches all parts of the hall.

-Regardless of the surface, sound reflection may be explained as being similar to that of light. In terms of that medium, it's known as a sound reflection.

-Sound bounces off the medium's surface, which might be solid or liquid. The surface might be big and either rough or polished in order for sound to be reflected.

Conclusion

The general, concave surfaces focus sound waves, thereby concentrating the sound in specific areas, and convex shapes scatter sound, thereby promoting good diffusion. The reflection of a wave is simply a process by which a wave, whether light, sound, infrared, or radio waves, hits an

object and bounces off it. But this reflection looks quite different for a mirror than it does for a wall. maximum speed of sound moving through a solid or a liquid has just been calculated for the first time. It is about 36 kilometres per second, more than 8000 times lower than the speed of light in a vacuum. Any smooth and hard surfaces like walls, rocks, pillars, wood, metal sheets, and glass will reflect sound waves and are known as good reflectors of sound. Unlike entirely smooth surfaces, certain materials absorb sound waves instead of reflecting them and are called bad reflectors of sound.

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