DOWNLOAD PDF SOUND REFLECTIONS

Chapter 1 : Reflections of a Sound - Wikipedia

If a reflected sound wave reaches the ear within seconds of the initial sound, then it seems to the person that the sound is prolonged. The reception of multiple reflections off of walls and ceilings within seconds of each other causes reverberations - the prolonging of a sound.

In specular reflection the phase of the reflected waves depends on the choice of the origin of coordinates, but the relative phase between s and p TE and TM polarizations is fixed by the properties of the media and of the interface between them. Reflection is enhanced in metals by suppression of wave propagation beyond their skin depths. Reflection also occurs at the surface of transparent media, such as water or glass. Diagram of specular reflection In the diagram, a light ray PO strikes a vertical mirror at point O, and the reflected ray is OQ. In fact, reflection of light may occur whenever light travels from a medium of a given refractive index into a medium with a different refractive index. In the most general case, a certain fraction of the light is reflected from the interface, and the remainder is refracted. This is analogous to the way impedance mismatch in an electric circuit causes reflection of signals. Total internal reflection of light from a denser medium occurs if the angle of incidence is greater than the critical angle. Total internal reflection is used as a means of focusing waves that cannot effectively be reflected by common means. X-ray telescopes are constructed by creating a converging "tunnel" for the waves. As the waves interact at low angle with the surface of this tunnel they are reflected toward the focus point or toward another interaction with the tunnel surface, eventually being directed to the detector at the focus. A conventional reflector would be useless as the X-rays would simply pass through the intended reflector. When light reflects off a material denser with higher refractive index than the external medium, it undergoes a phase inversion. In contrast, a less dense, lower refractive index material will reflect light in phase. This is an important principle in the field of thin-film optics. Specular reflection forms images. Reflection from a flat surface forms a mirror image , which appears to be reversed from left to right because we compare the image we see to what we would see if we were rotated into the position of the image. Specular reflection at a curved surface forms an image which may be magnified or demagnified; curved mirrors have optical power. Such mirrors may have surfaces that are spherical or parabolic. Refraction of light at the interface between two media. Laws of reflection Main article: Specular reflection If the reflecting surface is very smooth, the reflection of light that occurs is called specular or regular reflection. The laws of reflection are as follows: The incident ray, the reflected ray and the normal to the reflection surface at the point of the incidence lie in the same plane. The angle which the incident ray makes with the normal is equal to the angle which the reflected ray makes to the same normal. The reflected ray and the incident ray are on the opposite sides of the normal. These three laws can all be derived from the Fresnel equations. Mechanism Play media 2D simulation: White blur represents the probability distribution of finding a particle in a given place if measured. Light waves incident on a material induce small oscillations of polarisation in the individual atoms or oscillation of electrons, in metals , causing each particle to radiate a small secondary wave in all directions, like a dipole antenna. All these waves add up to give specular reflection and refraction, according to the Huygensâ€"Fresnel principle. In the case of dielectrics such as glass, the electric field of the light acts on the electrons in the material, and the moving electrons generate fields and become new radiators. The refracted light in the glass is the combination of the forward radiation of the electrons and the incident light. The reflected light is the combination of the backward radiation of all of the electrons. In metals, electrons with no binding energy are called free electrons. Lightâ€"matter interaction in terms of photons is a topic of quantum electrodynamics , and is described in detail by Richard Feynman in his popular book QED: The Strange Theory of Light and Matter. Diffuse reflection Main article: Diffuse reflection When light strikes the surface of a non-metallic material it bounces off in all directions due to multiple reflections by the microscopic irregularities inside the material e. This is called diffuse reflection. The exact form of the reflection depends on the structure of the material. The light sent to our eyes by most of the objects we see is due to diffuse reflection from their surface, so that this is our primary mechanism of physical observation. Retroreflector Some surfaces exhibit retroreflection. The structure of these surfaces is such that light is returned in the direction from which it came. Since the lenses of their eyes modify reciprocally the paths of the incoming and outgoing light the effect is that the eyes act as a strong retroreflector, sometimes seen at night when walking in wildlands with a flashlight. A simple retroreflector can be made by placing three ordinary mirrors mutually perpendicular to one another a corner reflector. The image produced is the inverse of one produced by a single mirror. A surface can be made partially retroreflective by depositing a layer of tiny refractive spheres on it or by creating small pyramid like structures. In both cases internal reflection causes the light to be reflected back to where it originated. This is used to make traffic signs and automobile license plates reflect light mostly back in the direction from which it came. When light reflects off a mirror , one image appears. Two mirrors placed exactly face to face give the appearance of an infinite number of images along a straight line. The multiple images seen between two mirrors that sit at an angle to each other lie over a circle. A square of four mirrors placed face to face give the appearance of an infinite number of images arranged in a plane. The multiple images seen between four mirrors assembling a pyramid, in which each pair of mirrors sits an angle to each other, lie over a sphere. If the base of the pyramid is rectangle shaped, the images spread over a section of a torus. In practice, these situations can only be approached but not achieved because the effects of any surface imperfections in the reflectors propagate and magnify, absorption gradually extinguishes the image, and any observing equipment biological or technological will interfere. Complex conjugate reflection In this process which is also known as phase conjugation , light bounces exactly back in the direction from which it came due to a nonlinear optical process. Not only the direction of the light is reversed, but the actual wavefronts are reversed as well. A conjugate reflector can be used to remove aberrations from a beam by reflecting it and then passing the reflection through the aberrating optics a second time. Other types of reflection Neutron reflection Materials that reflect neutrons , for example beryllium , are used in nuclear reactors and nuclear weapons. Sound reflection Sound diffusion panel for high frequencies When a longitudinal sound wave strikes a flat surface, sound is reflected in a coherent manner provided that the dimension of the reflective surface is large compared to the wavelength of the sound. As a result, the overall nature of the reflection varies according to the texture and structure of the surface. For example, porous materials will absorb some energy, and rough materials where rough is relative to the wavelength tend to reflect in many directionsâ€”to scatter the energy, rather than to reflect it coherently. This leads into the field of architectural acoustics , because the nature of these reflections is critical to the auditory feel of a space. In the theory of exterior noise mitigation , reflective surface size mildly detracts from the concept of a noise barrier by reflecting some of the sound into the opposite direction. Sound reflection can affect the acoustic space. Seismic reflection Further information: Study of the deep reflections of waves generated by earthquakes has allowed seismologists to determine the layered structure of the Earth.

Chapter 2 : Reflection, Refraction, and Diffraction

Reflection of Sound. The reflection of sound follows the law "angle of incidence equals angle of reflection", sometimes called the law of www.nxgvision.com same behavior is observed with light and other waves, and by the bounce of a billiard ball off the bank of a table.

Rather, a sound wave will undergo certain behaviors when it encounters the end of the medium or an obstacle. Possible behaviors include reflection off the obstacle, diffraction around the obstacle, and transmission accompanied by refraction into the obstacle or new medium. In this part of Lesson 3, we will investigate behaviors that have already been discussed in a previous unit and apply them towards the reflection, diffraction, and refraction of sound waves. Reflection and Transmission of Sound When a wave reaches the boundary between one medium another medium, a portion of the wave undergoes reflection and a portion of the wave undergoes transmission across the boundary. As discussed in the previous part of Lesson 3 , the amount of reflection is dependent upon the dissimilarity of the two media. For this reason, acoustically minded builders of auditoriums and concert halls avoid the use of hard, smooth materials in the construction of their inside halls. A hard material such as concrete is as dissimilar as can be to the air through which the sound moves; subsequently, most of the sound wave is reflected by the walls and little is absorbed. Walls and ceilings of concert halls are made softer materials such as fiberglass and acoustic tiles. These materials are more similar to air than concrete and thus have a greater ability to absorb sound. This gives the room more pleasing acoustic properties. Reflection of sound waves off of surfaces can lead to one of two phenomena - an echo or a reverberation. A reverberation often occurs in a small room with height, width, and length dimensions of approximately 17 meters or less. Why the magical 17 meters? The effect of a particular sound wave upon the brain endures for more than a tiny fraction of a second; the human brain keeps a sound in memory for up to 0. If a reflected sound wave reaches the ear within 0. The reception of multiple reflections off of walls and ceilings within 0. This is why reverberations are common in rooms with dimensions of approximately 17 meters or less. Perhaps you have observed reverberations when talking in an empty room, when honking the horn while driving through a highway tunnel or underpass, or when singing in the shower. In auditoriums and concert halls, reverberations occasionally occur and lead to the displeasing garbling of a sound. But reflection of sound waves in auditoriums and concert halls do not always lead to displeasing results, especially if the reflections are designed right. Smooth walls have a tendency to direct sound waves in a specific direction. Subsequently the use of smooth walls in an auditorium will cause spectators to receive a large amount of sound from one location along the wall; there would be only one possible path by which sound waves could travel from the speakers to the listener. The auditorium would not seem to be as lively and full of sound. Rough walls tend to diffuse sound, reflecting it in a variety of directions. This allows a spectator to perceive sounds from every part of the room, making it seem lively and full. For this reason, auditorium and concert hall designers prefer construction materials that are rough rather than smooth. Reflection of sound waves also leads to echoes. Echoes are different than reverberations. Echoes occur when a reflected sound wave reaches the ear more than 0. If the elapsed time between the arrivals of the two sound waves is more than 0. In this case, the arrival of the second sound wave will be perceived as a second sound rather than the prolonging of the first sound. There will be an echo instead of a reverberation. Reflection of sound waves off of surfaces is also affected by the shape of the surface. As mentioned of water waves in Unit 10 , flat or plane surfaces reflect sound waves in such a way that the angle at which the wave approaches the surface equals the angle at which the wave leaves the surface. This principle will be extended to the reflective behavior of light waves off of plane surfaces in great detail in Unit 13 of The Physics Classroom. Reflection of sound waves off of curved surfaces leads to a more interesting phenomenon. Curved surfaces with a parabolic shape have the habit of focusing sound waves to a point. Sound waves reflecting off of parabolic surfaces concentrate all their energy to a single point in space; at that point, the sound is amplified. Perhaps you have seen a museum exhibit that utilizes a parabolic-shaped disk to collect a large amount of sound and focus it at a focal point. If you place your ear at the focal point, you can hear even the faintest whisper of a friend standing across the room. Parabolic-shaped satellite disks use this same principle of reflection to gather large amounts of electromagnetic waves and focus it at a point where the receptor is located. Scientists have recently discovered some evidence that seems to reveal that a bull moose utilizes his antlers as a satellite disk to gather and focus sound. Finally, scientists have long believed that owls are equipped with spherical facial disks that can be maneuvered in order to gather and reflect sound towards their ears. The reflective behavior of light waves off curved surfaces will be studies in great detail in Unit 13 of The Physics Classroom Tutorial. Diffraction of Sound Waves Diffraction involves a change in direction of waves as they pass through an opening or around a barrier in their path. In that unit, we saw that water waves have the ability to travel around corners, around obstacles and through openings. The amount of diffraction the sharpness of the bending increases with increasing wavelength and decreases with decreasing wavelength. In fact, when the wavelength of the wave is smaller than the obstacle or opening, no noticeable diffraction occurs. Diffraction of sound waves is commonly observed; we notice sound diffracting around corners or through door openings, allowing us to hear others who are speaking to us from adjacent rooms. Many forest-dwelling birds take advantage of the diffractive ability of long-wavelength sound waves. Owls for instance are able to communicate across long distances due to the fact that their long-wavelength hoots are able to diffract around forest trees and carry farther than the short-wavelength tweets of songbirds. Low-pitched long wavelength sounds always carry further than high-pitched short wavelength sounds. Scientists have recently learned that elephants emit infrasonic waves of very low frequency to communicate over long distances to each other. Elephants typically migrate in large herds that may sometimes become separated from each other by distances of several miles. Researchers who have observed elephant migrations from the air and have been both impressed and puzzled by the ability of elephants at the beginning and the end of these herds to make extremely synchronized movements. The matriarch at the front of the herd might make a turn to the right, which is immediately followed by elephants at the end of the herd making the same turn to the right. Only recently have they learned that the synchronized movements are preceded by infrasonic communication. While low wavelength sound waves are unable to diffract around the dense vegetation, the high wavelength sounds produced by the elephants have sufficient diffractive ability to communicate long distances. Bats use high frequency low wavelength ultrasonic waves in order to enhance their ability to hunt. The typical prey of a bat is the moth - an object not much larger than a couple of centimeters. Bats use ultrasonic echolocation methods to detect the presence of bats in the air. The answer lies in the physics of diffraction. As the wavelength of a wave becomes smaller than the obstacle that it encounters, the wave is no longer able to diffract around the obstacle, instead the wave reflects off the obstacle. Bats use ultrasonic waves with wavelengths smaller than the dimensions of their prey. These sound waves will encounter the prey, and instead of diffracting around the prey, will reflect off the prey and allow the bat to hunt by means of echolocation. Refraction of Sound Waves Refraction of waves involves a change in the direction of waves as they pass from one medium to another. Refraction, or bending of the path of the waves, is accompanied by a change in speed and wavelength of the waves. So if the media or its properties are changed, the speed of the wave is changed. Thus, waves passing from one medium to another will undergo refraction. Refraction of sound waves is most evident in situations in which the sound wave passes through a medium with gradually varying properties. For example, sound waves are known to refract when traveling over water. Even though the sound wave is not exactly changing media, it is traveling through a medium with varying properties; thus, the wave will encounter refraction and change its direction. Since water has a moderating effect upon the temperature of air, the air directly above the water tends to be cooler than the air far above the water. Sound waves travel slower in cooler air than they do in warmer air. For this reason, the portion of the wavefront directly above the water is slowed down, while the portion of the wavefronts far above the water speeds ahead. Subsequently, the direction of the wave changes, refracting downwards towards the water. This is depicted in the diagram at the right. Refraction of other waves such as light waves will be discussed in more detail in a later unit of The Physics Classroom Tutorial.

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Chapter 3 : NCDEQ - Sound Reflections

Reflection is responsible for many interesting phenomena. Echoes are the sound of your own voice reflecting back to your ears. The sound you hear ringing in an auditorium after the band has stopped playing is caused by reflection off the walls and other objects.

Reflection, diffusion and absorption of sound When sound hits a solid surface, it can either be reflected, diffused or absorbed. How does sound work? Sound travels as a longitudinal wave - a wave that causes air to compress and expand in the same direction as it travels. A sound will vibrate the particles in a material, whether it is a gas, liquid or solid, losing a little bit of kinetic energy with each further movement. The most effective method of stopping sound from travelling is by putting some kind of vacuum in its path. This is why in space, no-one can hear you scream! Any given material will pass on a small amount of the wave to some extent, and the greater the distance it is passed, the less noisy the sound is on the other side of the material. The frequency of the sound wave, without getting technical, is the measure of how high or low the sound appears to the listener. Deeper sounds like bass from a stereo are low frequency, higher sounds such as speech are around the mid to high level frequency range. What are reflection, diffusion and absorption of sound? A sound wave can be controlled in one of three different ways â€” it can be reflected, diffused or absorbed. Each of these reactions will depend entirely on the nature and composition of the material it comes into contact with, and each can be used to some extent in soundproofing. Below is a brief explanation of what happens in each case. Reflection Sound is bounced off a surface. This usually occurs on flat, rigid surfaces with a lot of mass like concrete or brick walls. The sound bouncing back off the surface creates an echo. Diffusion When a sound wave hits an irregular surface like foam or carpet, the vibration breaks up and travels along many much smaller paths. This divides the energy of the wave, sending it in many different directions which depletes its energy faster. Absorption When a sound wave hit a particular surface, the kinetic energy driving it is converted into a small amount of heat energy which dissipates, leeching power from the sound wave and causing it to decaying faster. This is the kind of sound insulation provided by things like foam and rubber. How well a material absorbs sound depends on a number of different factors, including material density and how porous it is. Advertisement Which is the most effective method of soundproofing? Reflection is often used to redirect noise from outside - consider highway barriers, which reflect traffic noise into the sky. If you can always control the way sound is reflected then this type of soundproofing can be effective. Reflective barriers are a good way to block out exterior noise. Diffusion is a great way to prevent echoes, dispersing the sound wave in all directions when it hits an irregular surface. Think about how much of a difference carpet or a wall rug can make in a brick or concrete room. This method is very effective for high to medium frequencies, as the vibration strength is less than that of a low frequency sound, and therefore easier to disperse. Absorption performance varies a lot based on the frequency of sound and the absorptive capabilities of the material. Absorption works best in mid to high frequencies - lower frequency sounds can push through with more force.

Chapter 4 : Reflection (physics) - Wikipedia

sound reflection - the repetition of a sound resulting from reflection of the sound waves; "she could hear echoes of her own footsteps" echo, reverberation, replication reflectivity, reflexion, reflection - the ability to reflect beams or rays.

Ultrasound Laws of Reflection The laws of reflection are the same for all types of waves, including light and sound. The diagram below shows light reflecting in a mirror: Angles of incidence and reflection are normally no pun intended! This all works OK for flat surfaces - normal mirrors around the house, or flat walls reflecting sound waves in an acoustic application. Curved Reflectors If a curved surface is used to reflect waves, they can be focused onto a point. The diagrams below show both a spherical and parabolic mirror shape: Parabolic mirrors are especially useful, and they have one focus point. Curved satellite dishes are used to transmit or receive radio waves. Even sound can be focused with a curved surface - for instance whispering galleries. The above photo shows a music recital room. There is a big concave surface forming one of the walls, which without treatment, would have caused sound to be focussed to a particular place in the room leading to the sound being uneven across the room. To deal with this, a surface diffuser has been added, if you look carefully you can see that the surface is wiggly. This breaks up the focussing and removes the distortion that the curved surface would have caused by reflecting the sounds into lots of different directions. The diffuser used to treat the recital room is shown below: Echoes When you shout near a tall building or under a bridge, the sound is reflected back from the walls. You hear this reflected sound as an echo. The time it takes for the echo to reach you can be used to calculate your distance from the wall. If the sound takes one second to go to the wall and back again how far away is the wall? If a trumpet plays on the stage, the sound can reflect off the back wall and return to the front of the seating stalls still quite loud. Sometimes this sound can be heard by the audience as an echo. To overcome this problem, absorbs can be put on the rear wall to stop the sound reflecting, as was done in the Royal Festival Hall, London shown below. Nowadays, it is more normal to use diffusers to disperse the reflection causing the echo. Echoes are used in Sonar and Radar. Both systems send out waves sound waves in water and electromagnetic waves in air, respectively and record the time it takes for the reflections to arrive back. From this they can detect nearby reflective objects. You also get sound radar, called SODAR which is used to detect wind speed and temperature in the atmosphere. Ultrasound is very high-frequency acoustic energy, typically between 1 and 3MHz - much higher than the frequency range audible to humans kHz. This high frequency means that the patient is not disturbed by the noise, and high amplitudes can be used, but primarily ultrasound is chosen because high frequency sounds have small wavelength. This small wavelength allows a very high degree of image detail to be recorded. The speed of sound in air is much less than that in water and the human body is mostly water! This means that there is an acoustic impedance difference between the air and the body. This difference would normally mean that a large part of the ultrasound energy is reflected away from the body and wasted. To prevent this, the transducer that produces the ultrasonic waves is placed on the skin using a special gel. The speed of sound in the gel is part way between that in air and water, and it therefore creates a smooth transition for the sound waves resulting in less reflected wasted energy. This is an example of impedance matching.

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Chapter 5 : Reflection, diffusion and absorption of sound | BUILD

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To verify the laws of reflections of sound. The Theory What is reflection? 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. Do you know how sound propagates? 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. How do we describe the reflection of sound? The waves are called the incident and reflected sound waves. What are 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. The angle 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 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.

Chapter 6 : Sound Reflections -

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.

Chapter 7 : SOUND REFLECTION - crossword answers, clues, definition, synonyms, other words and ana

Sound Wave Reflection. As sound waves leave one medium and enter another, such as an air borne wave in a room reaching a brick wall, the wave will undergo certain characteristics.

Chapter 8 : Sound Reflections: 5 Trumpets Score & Parts: Richard Byrd

Over the last one year, the stress levels of the average American has been reported to rise significantly. This can be attributed to an increase in events like hurricanes, fires as well as unhealthy politics.

Chapter 9 : Sound Reflection | AS A Level Physics Revision | University of Salford

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.