

THE ART OF NOISE CANCELLATION

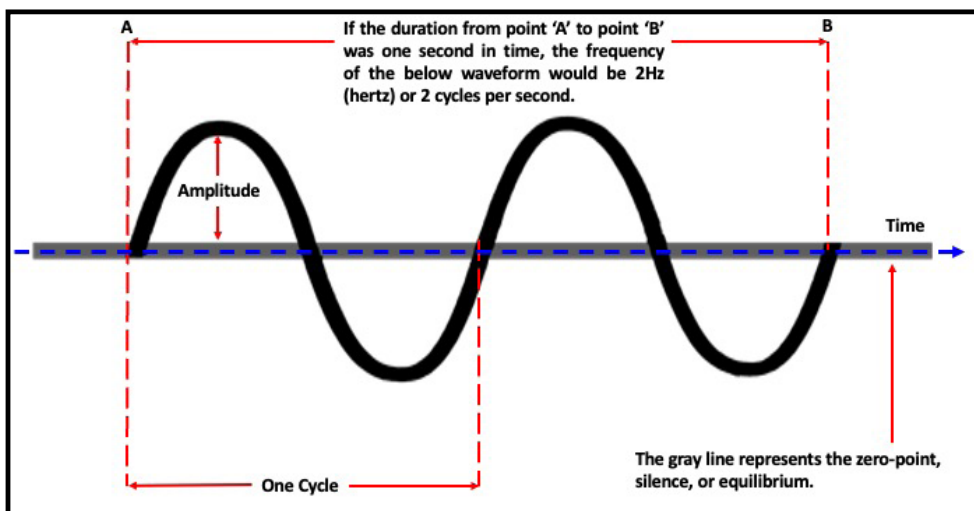
Chris Barton, FRC

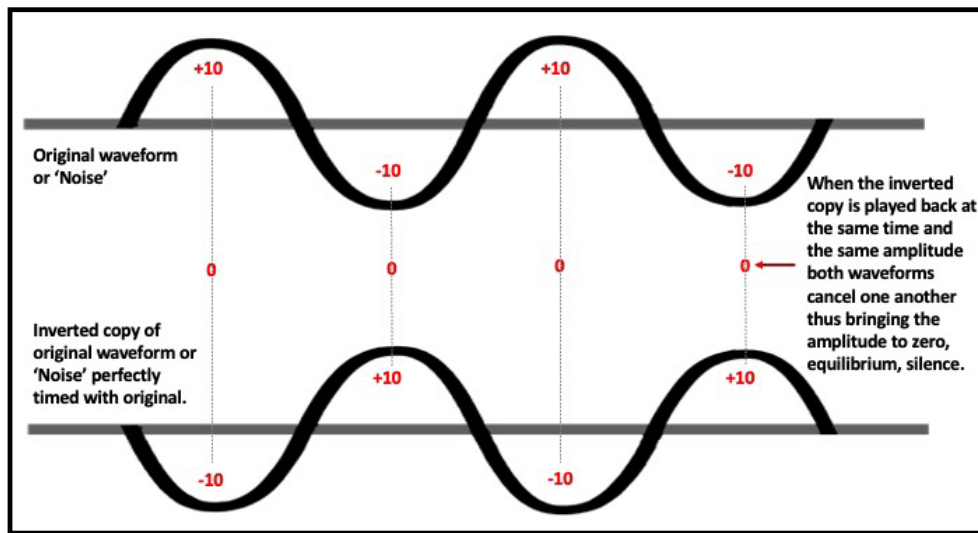
Nikola Tesla said, “If you want to find the secrets of the universe, think in terms of energy, frequency, and vibration.” What is a vibration? What is frequency? Simply stated, vibration is the oscillating, reciprocating, or other periodic motion of a rigid or elastic body or medium forced from a position or state of equilibrium. Some vibrations we are able to hear, others we feel, others are beyond our physical capabilities to readily perceive. This is where frequency becomes a factor. Frequency may be defined as the rate at which a vibration occurs that constitutes a wave, either in a material (as in sound waves), or in an electromagnetic field (as in radio waves and light), typically measured in cycles per second. Amplitude is another aspect most often attributed to vibration and frequency when it is with regard to sound; it is defined as the maximum extent of a vibration or oscillation, measured from the position of equilibrium. In summary, vibration is the cyclic oscillation back and forth over the point of equilibrium, or zero point; how fast the vibrational cycles are is its frequency; and how intense, or how far from equilibrium, or zero point, is the amplitude.

We could consider the zero point, or place of equilibrium, as unity, perfect silence, or the absence of vibration, frequency, and amplitude. As well, we could consider the presence of vibrations indicative of duality, fueled by the energy or emotion we exert. The duality is manifested through the action of oscillation from one pole to its exact opposite as time passes in a linear fashion. Like a pendulum that draws a line back and forth as it swings from pole to pole, with time passing perpendicular to the swing, it creates a waveform. It may be fast enough to hear or so slow it takes many lifetimes for even one cycle.

Unless we are living in a remote forest it is probable that we hear the normal hustle and bustle of the daily lives of those living around us in one form or another. It may be traffic if we live in the city, perhaps equipment or animals if we live on a farm, or maybe just the multitudes of people talking as we walk through our city streets. Most likely it is a combination of many things that cause background noise in our daily lives.

A very interesting invention, now called noise cancellation, was publicized

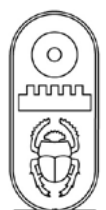




in 1933 in Germany, when Paul Lueg, a doctor of philosophy and medicine, submitted a patent application for the use of phase-advancing waves to cancel sinusoidal tones by inverting polarity to cancel sounds around a speaker. However, it would be many years later before the technology would become fast enough, and relatively inexpensive enough, to become available as a feature in many headphones. The beauty of this technology is that it is now fast enough to essentially “listen” to the noise around us and create an inverse copy of the waveform of that exact noise happening around us. Being exactly the same frequency and amplitude, and playing in perfect alignment with the original noise, silence is the result. If the original waveform begins at the zero point and moves to the left to an amplitude of +10 and the inverse copy, beginning at the exact same moment, moves to the right to an amplitude of -10, the result of both the original waveform and its inverse copy equals zero, silence. Sometimes lower quality noise-cancelling headphones will have slight remnants of the original sounds due to a slightly slower algorithm creating the inverse, or the headphones not having enough power to overcome the amplitude of the original waveform, as well as other anomalies. The point is that, with sound,

the exact opposite or inverse waveform played on top of the original waveform with the same amplitude cancels out the original sound. Sound is a vibration, just like thinking. Thought operates on a much higher frequency, yet the mechanics are no different.

Why is this important and of what value is this knowledge in real life, aside from cancelling out the noise around me when I am listening to music or a podcast? Excellent question indeed! I will use an example from my own experience, excluding granular details as they are unimportant. The Master Yeshua taught, in Matthew 5:44 (King James Version) to “Love your enemies, bless them that curse you, do good to them that hate you, and pray for them which despitefully use you, and persecute you.” Years ago I had a particular neighbor, and apparently while I was away working my dog had run up to this neighbor in his own yard and barked at him. Klank, my dog, was a 110-pound boxer and could look pretty intimidating when he wanted to, even though he was a total puppy inside. However, I was not made aware of the incident and one Sunday morning I was skateboarding in my driveway and this man showed up threatening to harm my dog. That did not go over so well with me. Eventually I



came to understand what had happened. The neighbor clearly needed to be heard so we went to his house to talk. I sat and listened to his stories of his time at war and fear of dogs in particular. I heard him, I sympathized, even empathized. When it was all said and done I expressed that it would never happen again, and thanked him for his service and sacrifice. However, for the next several months, every time I saw him drive by my heart would race, instant adrenaline; simply put, my anger would come to the surface. In my mind, I was absolutely justified in feeling all the things I felt. But that is not who I am and not who I aspire to be. With knowledge comes the responsibility to act accordingly.

What does noise cancellation technology have anything to do with this? Let me show you: “Love your enemies, bless them that curse you,” as Master Yeshua said. There is a fundamental truth here in what Yeshua was teaching, which is doing the exact opposite of what you might expect; blessing those that curse you. He gave this lesson to help lift the load of a heavy heart weighed down with anger and unforgiveness. He understood the necessity of figuratively having a heart as light as a feather. It was not complicated to understand what I needed to do. It was

not only to forgive the neighbor for any perceived wrongdoing, or for bruising my ego. No, my anger was solely mine regardless of whether or not he was oblivious to it or perhaps even felt it radiating from me every time we crossed paths. To just decide to forgive would not be enough; mathematically speaking his +10 on the amplitude chart would not be offset by my passive forgiveness or sitting on zero trying to maintain. There would still be a +5 that I would have to deal with, and I would deal with it forever. Unless it was absolutely cancelled out it would still exist, period. I had to go a step further; I had to wish him the best every time I saw him. So I did; as soon as I would think of him or see him, I would immediately visualize him in a field with the sun glistening on him as he laughed and smiled while doing acrobatics and radiating health and happiness. Was it difficult? To begin with yes, it went against everything my ego and emotions were telling me to do, but ultimately it was only as hard as I made it. Once I let go it became easy, and then, after having to repeat this exercise several times, eventually it became so easy that I never had to do it again. Anything less than the exact opposite would not balance the math: $+10$ and $-10 = 0$.

