Noise Power Spectrum for Firecrackers

K. B. Patange, Deogiri College, India
A. R. Khan, Maulana Azad College, India
S. H. Behere, Dr. Babasaheb Ambedkar Marathwada University, India
Y. H. Shaikh, Shivaji Arts, Commerce and Science College, India

ABSTRACT

Frequency of noise can affect human beings in different ways. The sound of firecrackers is a type of intensive impulsive noise, which is hazardous. In this paper, the noise produced by firecrackers during celebration festivals in Aurangabad (M.S.), India is measured. The noise is analyzed from the study of power spectra for different types of firecrackers. Noise measurements of firecrackers show that they produce high sound pressure peak levels at their characteristics frequencies. Plots of noise power versus frequency for different crackers are presented and the inferences are discussed. Typical firecracker peak noise levels are given.

Keywords: Fourier Transform, Frequency, Impulse, Noise Power Spectrum, Sound

INTRODUCTION

Sound level, its frequency spectrum and its variation over time characterize noise (Alam, 2006). Noise can also be characterized by its frequency content. This can be assessed by various types of frequency analysis to determine the relative contributions of the frequency components to the total noise (Berglund, 1999). Conventionally the range of frequency of audible sound is considered to be from 20 Hz to about 20,000 Hz (Carl, 2006). There are individual variations in the frequency of sound that can be heard by different individuals. The study of sound related noise includes the study of noise levels at different frequencies. A standard well known method to find out noise power associated with different frequencies is to use the Fourier transform technique (Berglund, 1995).

Fourier transform of sound reveals the amplitude of noise at the constituent frequencies from which one can estimate the corresponding power levels. The main principle of frequency analysis is that any selected frequency range is divided into a number of consecutive and discrete analysis bandwidths, such that the amount of energy present in each analysis bandwidth can be determined.

Firecrackers are used all over the world to celebrate different social as well as religious occasions. The firecrackers traditionally used for celebration are another major source of
excessive noise. They are used indiscriminately in residential areas, next to hospitals, schools, with little consideration for the effect on the well being of persons unable for a variety of reasons to bear the high level of noise created. Bombs, chain bombs, etc. are permitted for manufacture provided they do not exceed 125dB – the level of a jet engine taking off at 25 meters (Noise Free Mumbai). Firecrackers generate instantaneous impulsive noise, which when measured in free field condition gives high sound pressure level. An impulse is much more harmful than a continuous noise (Khopkar, 1993). A sudden noise generated with high pitch or intensity but with a life-time of less than one second is called as impulse. Impulses caused by an exploding bomb (190 dB), naval gun-shooting, firing crackers and metal beating, are capable of producing noise to the extent of 140 dB. An unexpected thud of sound with a short life has high impulse and is dangerous. It is quite obvious than a number of crackers when bursting serially can easily form a band of continuous noise in the presence of reflecting surfaces (West Bengal Pollution Control Board, 2005). Noise pollution due to bursting of firecrackers during Diwali was surveyed at 11 cities in the state of Maharashtra by Maharashtra pollution control board in the year 2005 and found that the noise levels in Aurangabad city are higher than the stipulated limits (Deshpande, 2005). To make matters more complicated, the frequency of noise can affect human beings in different ways. Fatigue and nausea often result from low-frequency vibration, while high frequencies are likely to cause pain and hearing loss. A number of adverse effects of noise in general may be greater for low frequency noise than for the same noise energy in higher frequencies (Goldstein, 1994).

Firecrackers may easily produce very high sound levels, and the noise they cause is of an impulsive nature, which means that it has a very short rise time, i.e., a very rapid onset (Miyara, 2010). This impulse type of noise can cause hearing damage. Noise measurements of firecrackers show that they produce high sound pressure peak levels (Tandon, 2003). The emission of a peak sound pressure level at a given location due to an individual firecracker depends mainly on its sound power, the distance from explosion, and the sound pressure distribution in the time and frequency domain. Noise produced by such activities can cause annoyance and concern regarding the health of people as well as impact on wild and domestic animals. Repeated exposure to such explosions can lead to the development of stress-related diseases. Apart from casualties and permanent hearing loss, such explosions cause numerous extra-aural effects, especially to persons not expecting them. Every strong explosion acts as a stress factor, in this way it presents a serious health hazard, especially for more sensitive people. Firecracker explosions belong to a group of intensive impulsive noises, which are particularly hazardous. Their sound pressure level at a distance of few meters can greatly exceed 140 dB, the level adopted for hearing protection (Cudina, 2005).

The present work deals with the analysis of recorded audio data from the point of view of the power levels present at different frequencies.

Methodology

The study comprises analysis of various types of sound including noise recorded from bursting firecrackers. The sound was recorded in standard Windows wave file format with .WAV extension. This format in addition to all the recorded audible data contains information about the sampling frequency and other related technical details. These sound files in wave format are opened and read in MathCAD program. Most of the data files used for this purpose were recorded at a sampling rate of 44.1 KHz with single channel and 16 bit resolution. This allows for a resolution of 1 part in 65536, a reasonably high resolution. Each sampling point therefore requires two bytes (16 bits of data), this results in a data rate of 88.2 K Bytes per second.
Analysis of Neural Network of C.elegans by Converting into Bipartite Network
International Journal of Artificial Life Research (pp. 10-21).
www.igi-global.com/article/analysis-neural-network-elegans-converting/65072?camid=4v1a