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# Noise Power Spectrum for Transfer Press Machines

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**Abstract: It is known that exposure to loud noise for prolonged periods of times is dangerous and can affect quality of life with reference to health and psychology. In severe cases it may result in damage or permanent loss of hearing. Exposure to 85 dB noise for more than eight hours and 100 dB noise for more than two hours is considered to be dangerous for humans. We studied noise due to machinery in use with heavy industry and present finding and details on noise due to Transfer Press Machine used in forming of heavy metal sheets.**

**Keywords:** Noise, Power Spectrum, Transfer Press Machine, Fourier transform.

## 1. Introduction

The quality of life is affected by exposure to loud noise and it has serious effects particularly with reference to health and psychology [9]-[11]. Noise at higher frequencies is more annoying and has adverse effect on health and psychology of the residents in nearby areas. Major part of the noise in the urban areas comes from activities of various kinds such as Industry, traffic, construction work and operation of machinery and thus this noise is becoming serious concern. In view of this, the study of noise assumed importance in recent times and regulations and norms are laid down for noise and its control.

Frequency distribution of noise helps characterizing noise and provides deeper insight in to the likely hazards it may cause. Such study in turn helps understanding the origin of noise from different parts of the activity and machines and is useful in finding plausible methods of controlling the same[1]-[4]. In view of this we studied frequency distribution of noise arising from Transfer Press Machine used in forming metal sheets. The results obtained are interesting and clearly characterize various sounds. Sound level, its frequency spectrum and its variation over time characterize noise to estimate its hazards [5]. Noise can also be characterized by its frequency content and noise power spectrum analysis with many applications; this approach makes use of Fourier Transform technique [6].

Recordings of Noise in general give an impression of noise and allow a qualitative feel of the nature of noise regarding the distribution of intensity of sound at different constituent frequencies. However the frequency analysis of the audio recording of noise using Fourier transform technique reveals interesting finer details hidden into the whole sound. The Frequency spectrum [7] of noise obtained using Fourier transform [8] of the noise recording will clearly show distinct frequencies at which noise is present that too in what proportion. Similarly it will clearly categorize various frequencies over which appreciable noise is present, also it will show frequencies over which noise remains low. The amplitudes of sound obtained using FFT are complex quantities having both real and imaginary component and the value of amplitude is found by taking the absolute value of this complex amplitude from which power can be found. The frequency analysis of noise audio recordings provides a reliable means to understand

the frequency distribution of noise and the characteristic frequencies of sound produced by various parts of machines

## 2. Methodology

For the purpose of finding out power spectrum of the noise produced by Transfer Press Machine (TPM) used in industry for forming metal sheet where lot of noise is generated the sound samples were recorded during different operations. Recording was implemented using standard sound system with dynamic microphone and the recorded noise was saved in standard wave format files with ".WAV" file extension for further use. The frequency distribution of noise in these samples was found using FFT. The wave files were analyzed using Fourier transform technique in Mathcad and the noise amplitude at different frequencies was saved in file for further processing and estimation of noise power. This technique is used for Transformation of time domain data into frequency domain. The wave files contain information on sampling frequency, the data size etc that is used in the Mathcad programs for finding out the power spectrum the sampling rate used throughout the study was 44.1 KHz and the data size was 16 bit.

After reading the audio file in Mathcad program the length of the audio file is determined, the time for each sample is estimated from the sampling rate and an array corresponding to the data points is generated and populated. Fourier transform requires that the number of data point used comply with Nyquist Criterion, thus from the data read, a suitable interval is chosen. For FFT the number of data points should be equal to 2N where N is an integer. In most of the studies we used 8192 data points which corresponds to N = 13 and the sample studied has a duration of little less than 0.2 seconds of recorded sound. On implementation of the FFT this gives power spectrum in terms of audio powers at different frequencies. The number of frequencies at which the power spectrum is available is half of the number of data points used i.e. 8192 / 2 = 4096, thus FFT extracts power at 4096 frequencies. The resulting power in the power spectrum is a complex quantity due to reasons presented earlier. The magnitude of power can be estimated using the modulus of this complex amplitude from FFT.

## 3. Noise from Transfer Press Machine :

Noise power spectrum obtained from two samples from 1250 Ton Transfer Press Machine (TPM) used in heavy industry are shown in Fig. 1. The power spectra for the two samples are not much different and are typical representative of the noise when the machine is idle and not performing any task. As this is a heavy machine with huge parts the characteristic frequencies associated with the vibrations and motion of such parts are on the lower side which is also reflected from the noise power spectra for the two samples. The entire noise contributed is solely concentrated in lower frequency rage and marginal or no appreciable power is seen at frequencies above 1 KHz.

Major part of the noise present is distributed up to 500 Hz with sharp spike likes peaks randomly distributed that overlap at few places and elsewhere there is no correlation.

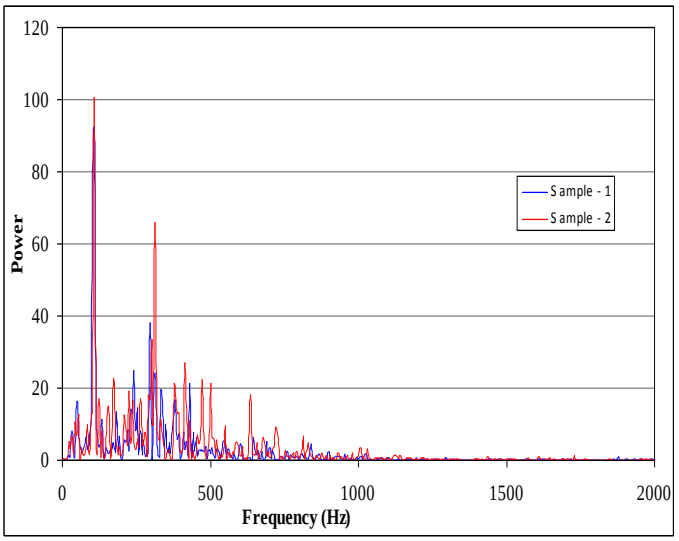


Fig. 1 Noise Power spectrum for from 1250 Ton Transfer Press Machine when idle.

The two prominent peaks in each of the two samples correspond to the main vibrating part of the machine and are located near 100 and 300Hz respectively.

At the time of stroke of the machine, a lot of noise is generated as other parts of the machine such as the base stand, the job mount etc are also under the huge impact of pressing and 1250 Ton is rally a heavy stroke making everything shake producing sound and noise of all sorts. Two typical power spectra of the stroke of 1250 Ton TPM are shown in Fig. 2.

It is clearly seen from the two noise power spectra that the noise is distributed over a wide range of frequencies, right from very low frequencies up to frequencies as high as 12 KHz touching the boundaries of audible range. The small hump like broad peak below 1000Hz is the part of noise contributed by the

operation of the TPM shown in Fig. 1, which seems to be a minor contribution to the whole of noise. The broad cluster of humps and spikes around 6 KHz is the main noise in this sample arising from the heavy stroke of the 1250 Ton TPM when almost everything is shaken and set into vibration giving rise to noise at various frequencies. It is interesting to note that there is a strange silence zone (limited power) at frequencies around 2 KHz where very little noise is present. This is related to the technical aspect of the machine and the operation, the machine has big and heavy elements and parts and their natural frequencies are on the lower side and thus the sound and noise they contribute are on the lower side. The job being processed is of relatively smaller size and the job mount and the platform and associated parts are also relatively smaller in size and thus have higher natural frequencies and thus when set into vibration they produce sound corresponding to their natural frequencies. These frequencies including the various modes of vibration and overtones of the plates being pressed constitute this cluster in the range from 3 – 11 KHz the two plots are identical but do not exactly coincide as these samples are from two individual events and the conditions differ from stroke to stroke.

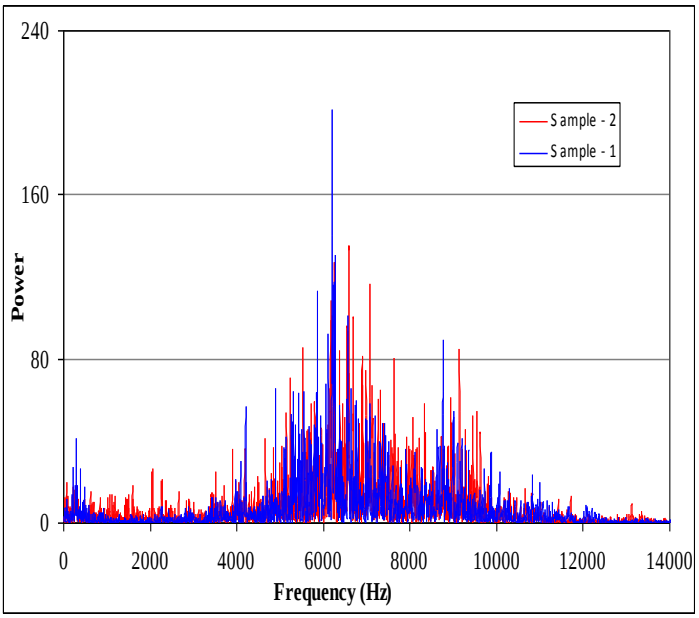


Fig. 2 Noise Power spectra (2 samples) for 1250 Ton Transfer Press Machine during stroke.

Noise levels were measured using standard calibrated sound level meter (CENTRE Model 223), when the machine is idle (not performing a stroke) the noise levels are in the range of 80 – 90 dB and at the time of stroke the noise levels exceed 110dB, particularly when simultaneous parallel activity of shifting and transfer of finished and unfinished job is in progress. Persons working regularly in such noisy environment are subject to noise-induced hearing loss (NIHL). The idle machine is operational almost continuously and produces noise at lower frequencies below 500Hz that is one of the major concern, additionally the main noise has a broad band structure with appreciable noise level at almost all audible frequencies.

## 4. Result and Discussion:

Machines like Heavy 1250 Ton Transfer Press Machine used in forming of thick metal sheets of constitute major component of noise in industries handling heavy metal sheet forming applications. The noise from such activities exceeds 110 dB during routine operations, and such noise levels fall in high risk regime and exposure to such noise levels continuously for several minute may cause damage to hearing. Fig. 1 shows that for 1250 TPM, in idle mode, which prevails for most of the time, the noise contributed is of low frequency which is major concern, also at the time of strokes the noise levels are too high and is distributed over a wide range of frequencies and such broad band noise has more severe effects.

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