

Study on mechanics of bodies under the action of sound pollution in industrial halls. Part II: Analysis of sound pressure inside the hall

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Abstract. In this work, it is taking into account all these phenomena of sounds propagation in given space. Within the framework of the given research is a study in industrial park "Teraplast" from Bistrița-Năsăud county. This is industrial products for pvc constructions. From the submissions made to the workshops of processing industrial park "Teraplast" has been found, that noise is produced mainly in the power pumps hall. The registrations were made during a normal working days. The recorders made, for one minute, with recorder (NL32, Japanese society RION) in the pump's hall 12 positions were introduced in a high-capacity computer. This second part of the paper contains a natural continuation of the study conducted in the first part. Through the composition of sound waves for each pump in part according to the construction of the hall, gives the sound field generated by sources of power pumps during simultaneous operation. Field of noise sources inside the hall of power pumps determines an acoustic pressure on the walls of the hall. Taking into consideration the frequencies that are threatening the construction of the hall, will be presented successively acoustic pressure what special expertise to the hall walls the pressures of 230Hz, 350Hz, 800Hz and 1400Hz. This study is important for the acoustic pressure made from the "Teraplast" enterprise inside, and outside the halls.

1. General considerations

The work contains a natural continuation of the study conducted in the first part, setting out the sources of noise and sound pressure level maximum local products inside the hall of power pumps from the enterprise "Teraplast" in Bistrita-Năsăud County [6].

Through the composition of sound waves for each pump in part according to the construction of the hall, gives the sound field generated by sources of power pumps during simultaneous operation.

2. Recording sound pollution supply pumps hall

Field of noise sources inside the hall of power pumps determines an acoustic pressure on the walls of the hall. From the composition of industrial noise produced by the 10 pumps inside the hall results that there are some special frequencies and they expertise strong the hall structure in which are mounted pumps [6].



From registered of the noise caused by the 10 pumps in their hall, because all work at the same time was needed in the composition of all registered made in the 12 points inside the hall it was obtained figure 1.

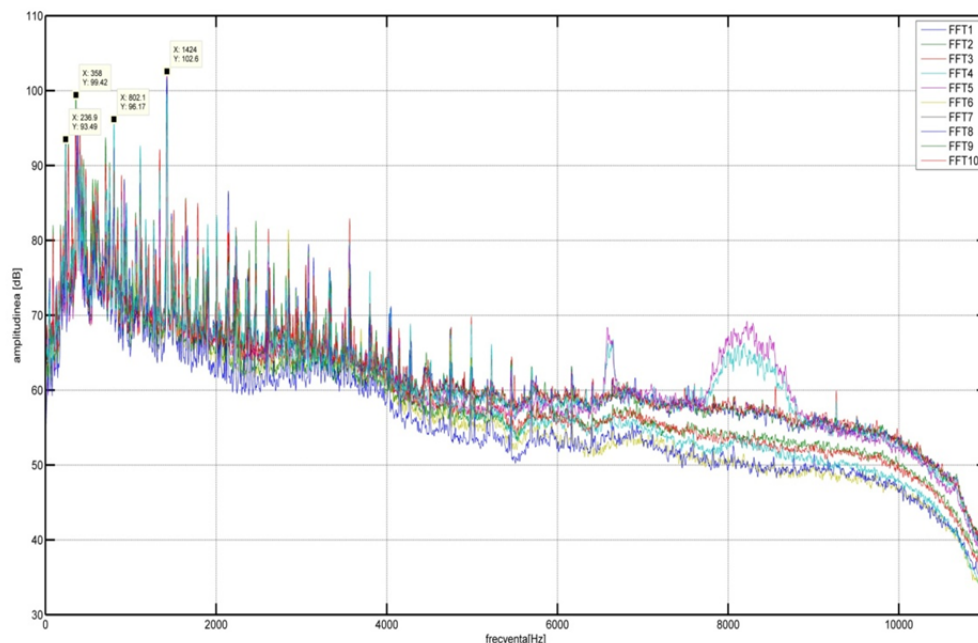


Figure. 1. Registration of all the ten points (two of them are superposed on another two). In the right side up in the graphical representation, the FFT_i where *i* contains the number of the registration point given by the position in the figure 2, of the first part of this paper.

Table 1. The highs recorded of noise pollution in pump hall.

Crt. No.	Frequency [Hz]	Amplitude [dB]
1.	234,2	92,06
2.	1424	105,3
3.	718,7	90,93
4.	2145	92

From comparing all records shall be fixed frequencies local maxims, the extreme values, centralized in the table 1. Partial results from the analysis of each point of measurement, remove the frequencies so companies: 230Hz, 350Hz, 800Hz and 1400Hz [4].

Through the composition of sound waves for each pump in part according to the construction of the Hall, the sound field generated by all sources is presented in the figure 2 [5].

3. Finite element analysis of sound pressure inside the pumps hall

Field of noise sources inside the power supply pumps hall, represented in figure 2, determines an acoustic pressure on the walls of the hall. From the composition of industrial noise produced by the 10 pumps inside the hall (figure 1) results that there are some special frequencies, that expertise, strong structure of the Hall in which are mounted pumps [1], [2], [3].

According to the documentation provided by the processor of plastics "Teraplast" in the city of Bistrita, the hall of supply pumps are considered a prism formed from:

- ground, floor or foundation which supports supply pumps;
- side walls, parallel each other and perpendicular to the surface of the support, of varying sizes;
- ceiling.

3.1. Sound pressure at 230Hz frequency

The acoustic pressure what special expertise in the walls and ceiling of the Hall, in interior part of hall, at the 230Hz frequency, was analyzed with finite element, according to the general theory.

The acoustic pressure is presented in figure 3, and it shows that: • on the first wall pressure is between 59.7 and 108 dB; • on the second wall pressure is between 64.9 and 109 dB; • on the third wall pressure is between 62.7 and 109 dB; • on the ceiling pressure is between 60.5 and 107 dB.

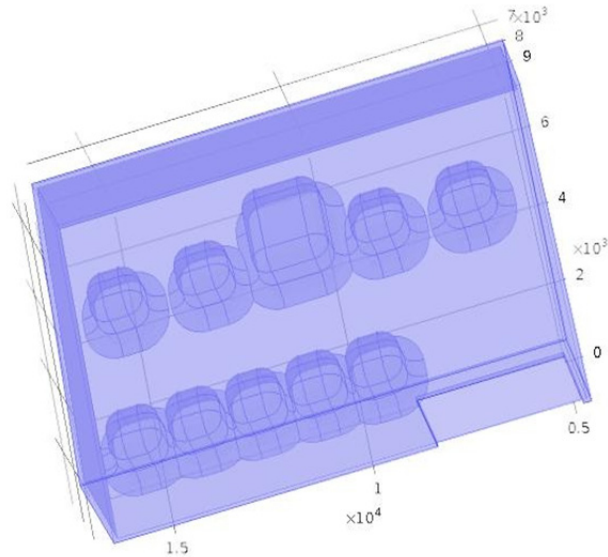


Figure 2. Sound sources field generated by functional pumps.

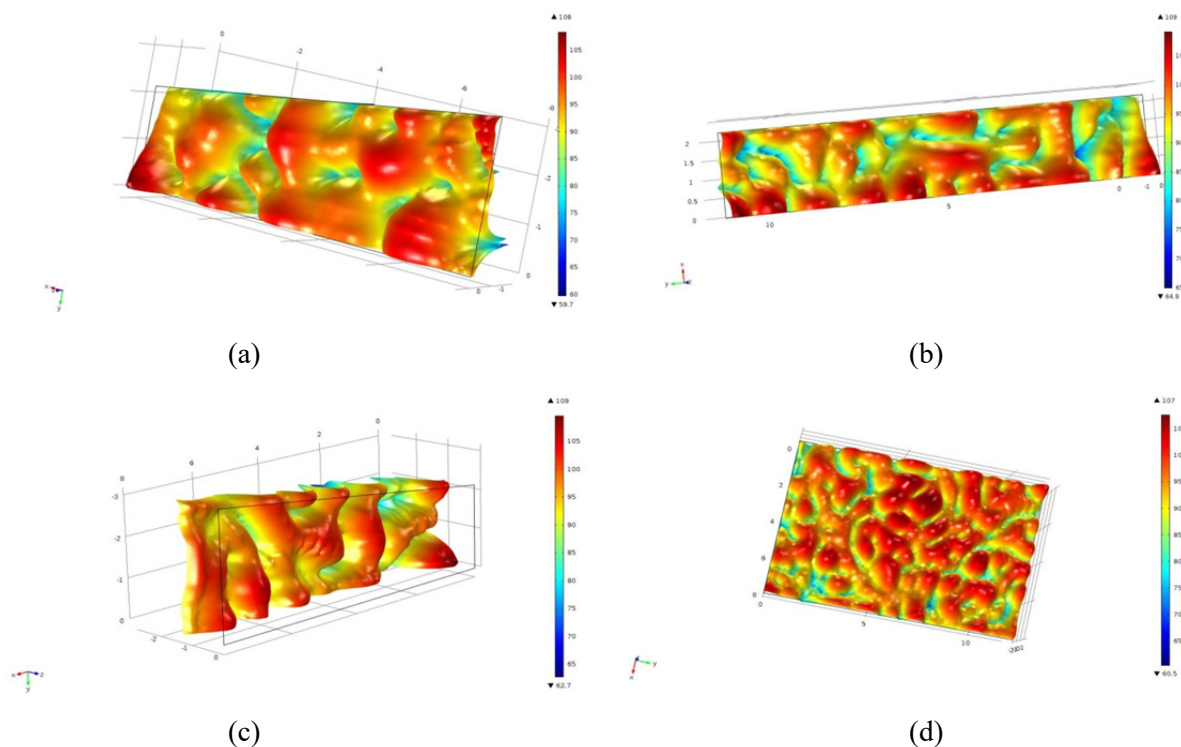


Figure 3. Acoustic pressure in pump supply warehouse at 230 Hz frequency: (a) first wall; (b) second wall; (c) third wall; (d) ceiling.

3.2. Sound pressure at 350Hz frequency

The acoustic pressure what special expertise in the walls and ceiling of the Hall, in interior part of hall, at the 350Hz frequency, was analyzed with finite element, according to the general theory. The acoustic pressure is presented in figure 4.

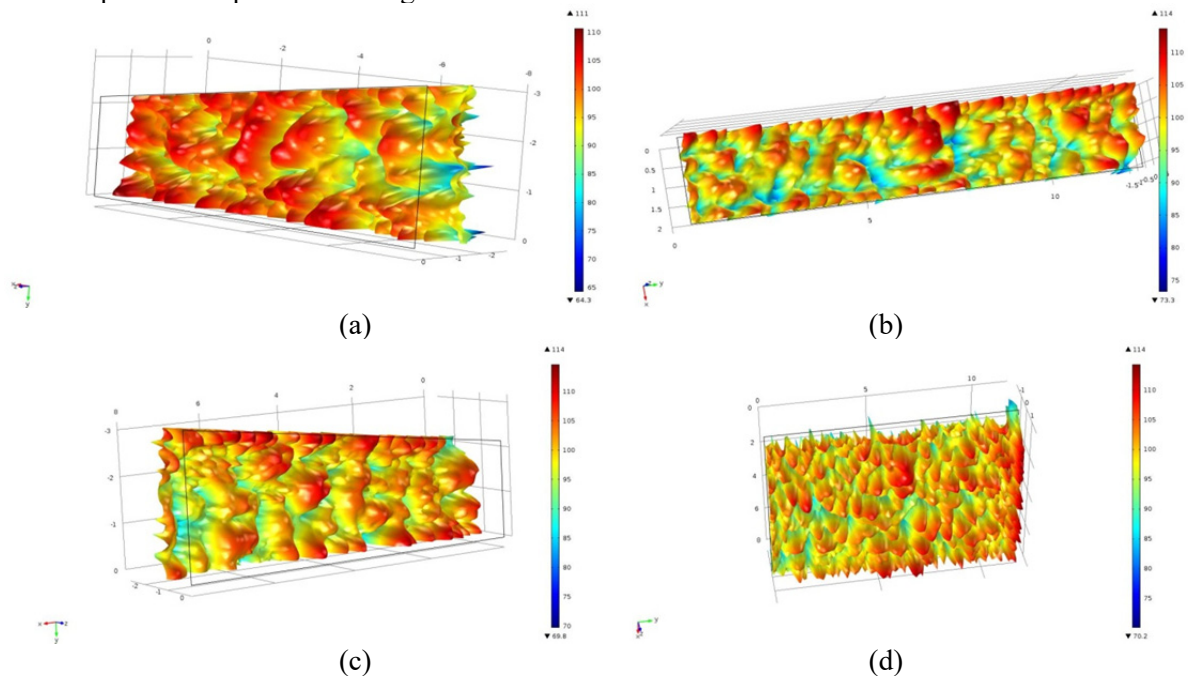


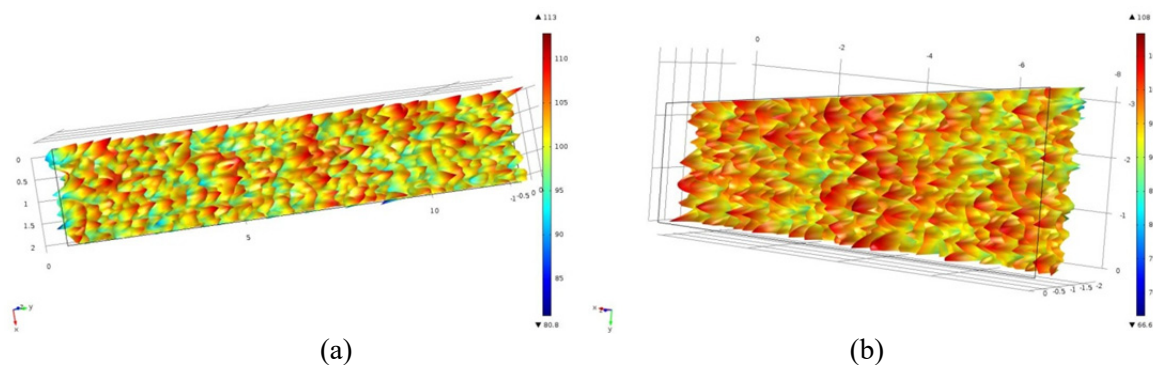
Figure 4. Acoustic pressure in pump supply warehouse at 350 Hz frequency: (a) first wall; (b) second wall; (c) third wall; (d) ceiling.

Figure 4 shows that: • on the first wall pressure is between 64.3 and 111 dB; • on the second wall pressure is between 73.3 and 114 dB; • on the third wall pressure is between 69.8 and 114 dB; • on the ceiling pressure is between 70.2 and 114 dB.

3.3. Sound pressure at 800Hz frequency

The acoustic pressure what special expertise in the walls and ceiling of the Hall, in interior part of hall, at the 800Hz frequency, was analyzed with finite element, according to the general theory. The acoustic pressure is presented in figure 5.

Figure 5 shows that: • on the first wall pressure is between 66.6 and 108 dB; • on the second wall pressure is between 80.8 and 113 dB; • on the third wall pressure is between 73.5 and 112 dB; • on the ceiling pressure is between 53.3 and 114 dB.



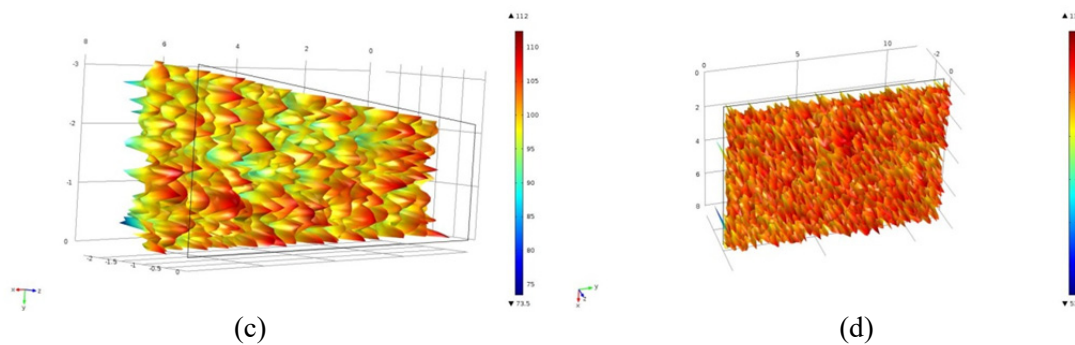


Figure 5. Acoustic pressure in pump supply warehouse at 800 Hz frequency: (a) first wall; (b) second wall; (c) third wall; (d) ceiling.

3.4. Sound pressure at 1400Hz frequency

The acoustic pressure what special expertise in the walls and ceiling of the Hall, in interior part of hall, at the 1400Hz frequency, was analyzed with finite element, according to the general theory. The acoustic pressure is presented in figure 6.

Figure 6 shows that: • on the first wall pressure is between 74 and 118 dB; • on the second wall pressure is between 73.9 and 121 dB; • on the third wall pressure is between 62.6 and 121 dB; • on the ceiling pressure is between 80.8 and 120 dB.

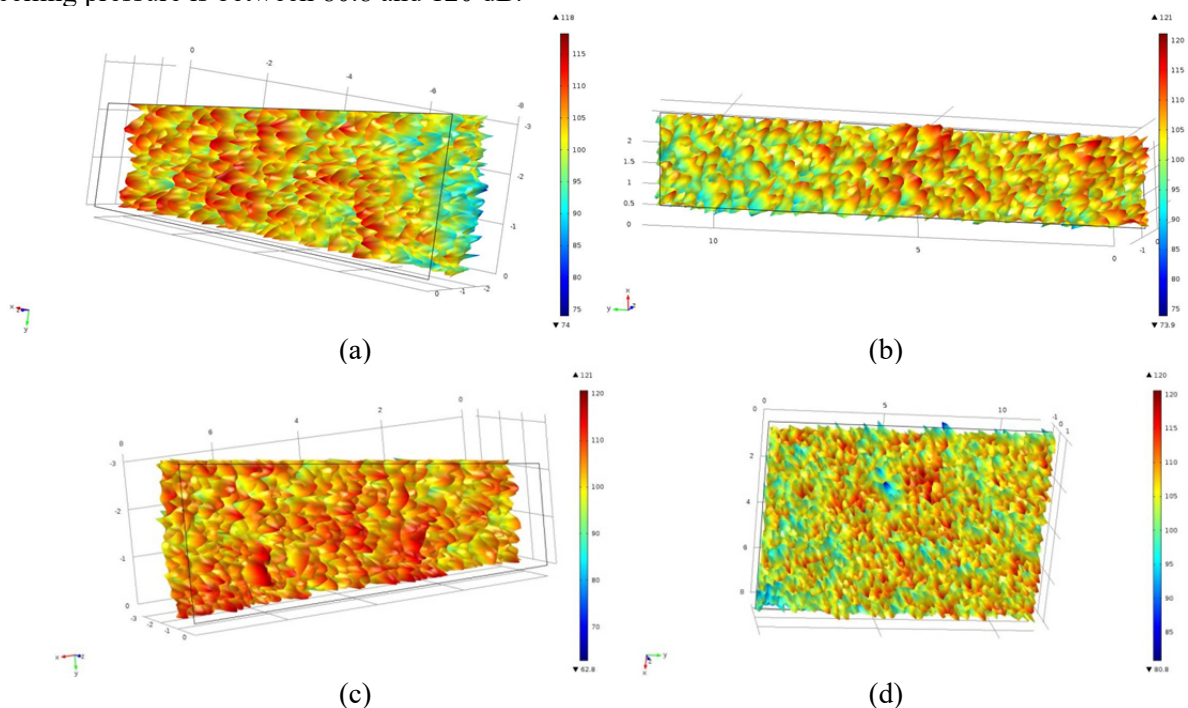


Figure 6. Acoustic pressure in pump supply warehouse at 1400 Hz frequency: (a) first wall; (b) second wall; (c) third wall; (d) ceiling.

4. Conclusions regarding indoor sound pressure in pump supply hall

In this paper sets out the action of sound pressure produced by supply pumps into the Hall the 10 pumps within the enterprise "Teraplast". This is a processing factory for plastics materials, which realises contestants' pipe dimensions and different profiles.

The enterprise is in the immediate neighbourhood of Bistrita municipality, why it was needed in the evaluation of noise pollution on this undertaking particularly factory of plastics, it produces in near the area of residential district.

With a tape recorder was marked the noise in the hall of power supply pumps, with which it was conducted analysis in the frequency of registrations, from which resulted the frequencies, which have maximum amplitudes during pumps activity.

With frequencies that are considered excessively demanding, it was passed to the finite element analysis of acoustic pressures, what solicit on the walls and ceiling of hall. It is centrally presented in table 4 the acoustic pressures inside the hall.

Table 2. The acoustic pressures inside the supply pumps hall

Crt. No.	Frequency [Hz]	Acoustic Pressure [dB]	First Wall	Second Wall	Third Wall	Ceiling
1.	230	minimă	59,7	64,9	62,7	60,5
		maximă	108	109	109	107
2.	350	minimă	64,3	73,3	69,8	70,2
		maximă	111	114	114	114
3.	800	minimă	66,6	80,8	73,5	53,3
		maximă	108	113	112	114
4.	1400	minimă	74	73,9	62,6	80,8
		maximă	118	121	121	120

From the summary table shown results in the following any frequency operating the fuel pump pressure acoustic maximum playing escapes pressure acoustic admissible inside industrial plants (which you had to exceed 85dB) as European standardization, which is applied in Romania as a national standard.

5. References

- [1] Lăpușan I L, Arghir M 2013 Studii și cercetări privind poluarea fonică în mediul industrial *Știință și Inginerie* **24** pp 267 – 272
- [2] Lăpușan I L, Arghir M 2014 Studii și cercetări privind poluarea sonoră în mediul industrial *Știință și Inginerie* **26** pp 161-168
- [3] Lăpușan I L, Arghir M 2014 The Present Stage of Noise Pollution in Industrial Environment *Acta Technica Napocensis: Applied Mathematics, Mechanics, and Engineering* **57(II)** pp 239-244
- [4] Lăpușan I L, Arghir M 2015 Contributions to the Experimental Study on the Sound Pollution in Industrial Environment – Theoretical Justification *Acta Technica Napocensis: Applied Mathematics, Mechanics, and Engineering* **58(IV)** pp 597-600
- [5] Lăpușan I L, Arghir M 2015 Contributions to the Experimental Study on the Sound Pollution in Industrial Environment – Measurements *Acta Technica Napocensis: Applied Mathematics, Mechanics, and Engineering* **58(IV)** pp 601-604