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DIAGNOSIS OF A MILL USED FOR POWDER SLAKED LIME MANUFACTURING

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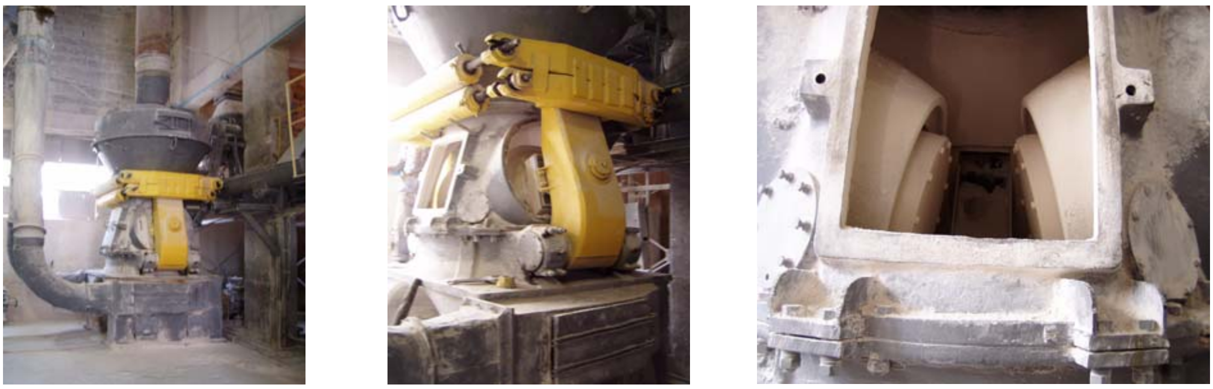
ABSTRACT
The main aim of this paper is to present the methodology and the experimental set-up used to determinate the causes of the gearbox crack of a mill used for powder slaked lime manufacturing. There are presented the equipment used, the methodology of equipment calibration and the realised measurements. At the end there are mentioned the main causes that can develop the gearbox frame collapse.
Keywords: *vibrations, mechanical structures diagnosis, signal processing.*

1. GENERAL CONSIDERATIONS
During the technological process of the powder slaked lime manufacturing there are used large mills (Figure 1,a & b) where slim balls are pressed in a system consisting of a rotating table and two pressing rolls (Figure 1,c). As a result of the technological process there are developed shock impulses with large amplitude that can have a bed influence on different parts of the mill. The most affected part of the whole mill is the gearbox that is situated between the electrical engine that provide the rotation motion and the rotating table. As a result of the shocks impulse the frame of the gearbox cracked around its base (Figure 2).



a) b) c)

Figure 1. Times new roman font, italic 11-pt. There should be one line space between figures and text.

To determinate the main cause of the gearbox crack there were made few sets of vibration accelerations measurements in different points of the structure.

Figure 2. Cracked gearbox frame around its base

Figure 3. Measurement set-up

The main tasks of the measurements were:

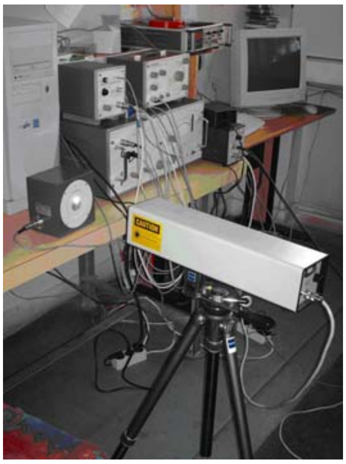
- To identify the possible excitation causes based on spectral analysis and correlation between the measured data and the dominant frequencies;
- Transmissibility estimation and the attenuation value of different parts of the mill structure focused on the gearbox frame;

2. EXPERIMENTAL SET-UP

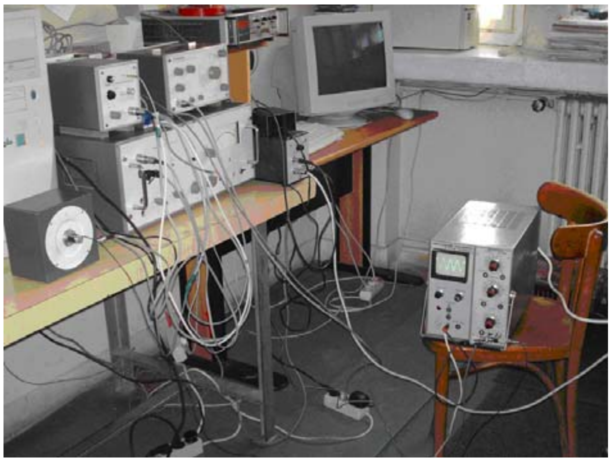
2.1. Calibration procedure

The measurement set up consists of the following components: accelerometers type KD23 and 12, data acquisition setup *National Instruments DAQPad-6015 (16 bit, 200 kS/s, USB), laptop Fujitsu-Siemens (512 Mb, Pentium 4, 1,8 GHz) and different accessories (Figure 3).*

The calibration activity was focused on establishing if the used accelerometers have the prescribed sensitivity that is given by the producer. The calibration set-up consists of: signal generator *E0502M, scope E0102, power amplifier AE 101 type 11072 (Messelectronik RFT), calibration system type 11072 (Messelectronik RFT), Laser velocity transducer TYPE 3544 (Bruel&Kjær); accelerometers type KD23 and KD12; acquisition data system National Instruments DAQPad-6015 (16 bit, 200 kS/s, USB);preamplifier RFT tip 20027;PC Pentium 4, 3GHz, and Soft TEST Point – Keithley Instruments Metrabyte şi LabView.*



a)



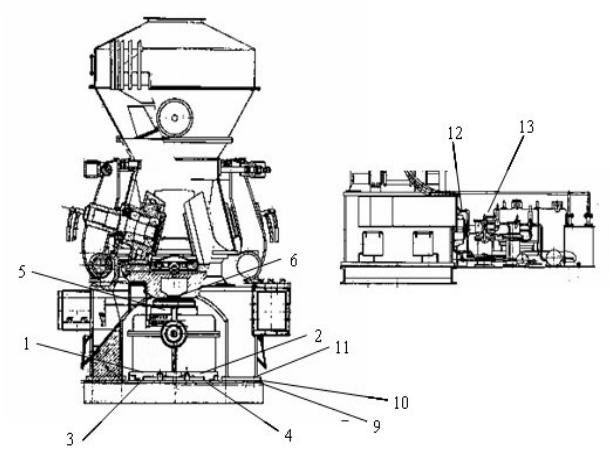
b)

Figure 4. Calibration system

It was checked the magnitude coefficient of the amplifier (n = 10). The accelerometers were checks considering the value of the vibration amplitude measured, at the same frequency (f=208.4 Hz.), with the accelerometers and with the Laser Velocity Transducer

2.2. Measurement procedure

There were considered 13 points of measurements (Figure 5). These points were choosed taking into consideration the whole structure (mill, electrical engine, gearbox, connections and foundation). In the same time there were analysed the manufacturing process characteristics (rotation of the rotating mass, the quantity of the powder slaked lime produced in one hour, admitted levels of forces, etc.)



a)

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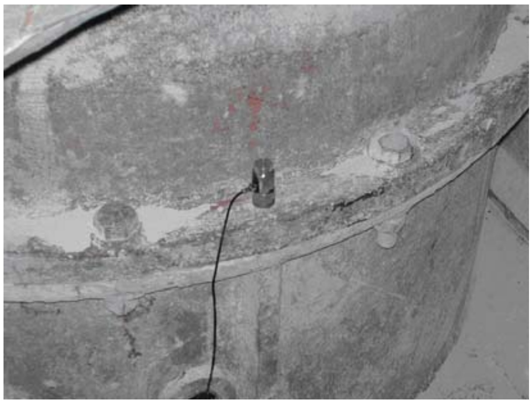

d)

e)

f)

Figure 5. Points of measurement: a) general presentation of the measurements points; b) point 1; c) point 2; d) point 6; e) point 12; f) point 13.

The highest level of the measured signal was detected at the entrance point of the gearbox (point 12 – Figure 6,a and Figure 7).

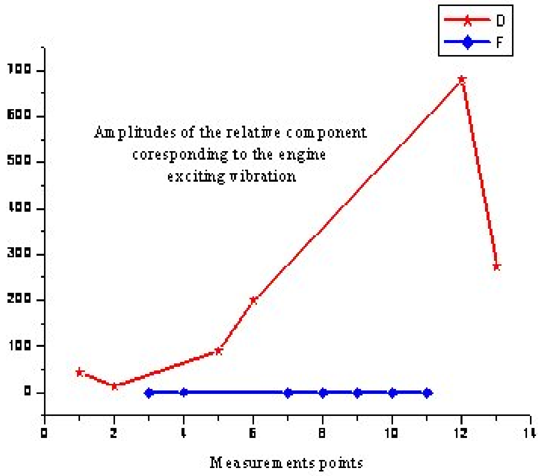

Figure 6. Amplitudes of vibration signal measured in different point of the gearbox

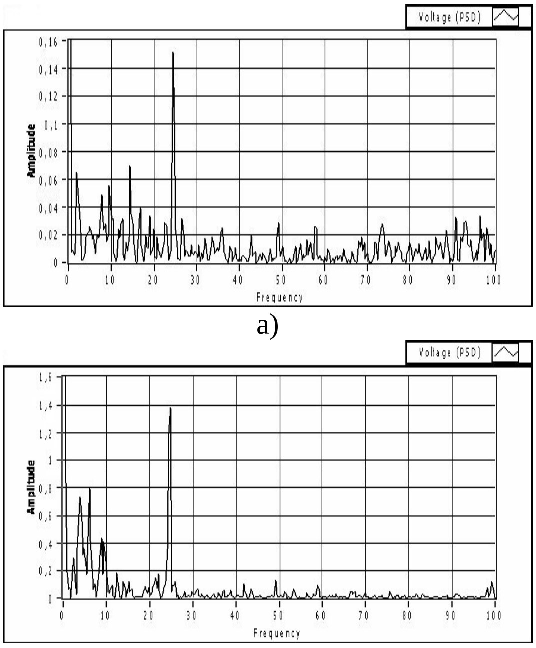

Figure 7. Signals from point 12: a) without load; b) during manufacturing

3. CONCLUSIONS

The experimental set-up permitted to highlight the following conclusions:

- There were identified some dominant frequencies that corresponds to the rotation motions of some parts of the mill as: rotating table, bearings and electrical engine and that that are associated with the ratio of transitions inside the gearbox;
- There are different levels of the vibration amplitudes of the mill structure in the considered points of measurements (Figures 5 and 6);
- The highest level of vibration amplitude is located in point 12 (Figure 7), on the gearbox, that is situated in place where is the radial-axial bearing at the rotating motion entrance in gearbox. As a possible cause was considered the wrong position (wrong connection) of the main shaft of the gearbox and the electric engine rotor;
- The high level of the vibration amplitude in point 1, that is situate on the base plate of the gearbox was cause by the wrong mounting of the screw and nut;
- The high level of the vibration amplitude, situated on the gearbox frame in the same place with the rotating mass is caused by a high level of the bearing wear and shocks that are developed during the manufacturing process;
- The assembly mill and foundation do not work as a single structure;
- The maximum value of shock is around 8g that is larger than the value considered in the mill design.

4. REFERENCES

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