Vibration and Diagnostic for a Cold Rolling Mills

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Abstract

This paper presents a system of monitoring and other parallel system for diagnose, used in a warm rolling mill.For bands rolling is required to make efforts in improving the quality of surface and smoothnes - especially for those intended for manufacturing of automobiles and of "equipment".
Also, in terms of reducing their weight by May thin strips - with superior mechanical characteristics (including no marks of steel covering and) In the process of cold rolling strips have to fulfill several conditions such as:

- *Geometry and surface quality of cold rolled strips, depending on their use;*
- *Correct leadership of the process of rolling;*
- *Highlighting the causes and effects oscilatiilor, vibration, shock - Due to its own system of rolling of chains and components of cinematic action;*
- *The establishment of measures for control, reduced management;*
- *Increasing productivity (output), reducing costs, in the end special effects and economic competivity.*

Key words: mill machine, sheet, oscillations

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1.INTRODUCTION

The first system (with specific sensors) is an online vibration monitoring system for control on-line the sheet quality- and mill maintenance in relation with diagnostic functions. The second system is used for monitoring the torque measuring and mill parameter (force, mill speed, the gap between work roll etc.) . This system make part from the integrate process control.

Vibrations are present in aggregates and rolling mill machinery of various types - sometimes with unknown motivations and variations in time.Through extensive research and experimentation conducted - with modern equipment, performance - have resulted number of issues - Synthetic presented in this paper. Defects printed on the tape rolled due osilatiilor, vibrations to which arise due process of deformation and the tandem mill - action, type: buckles with small step (about 20-50 mm), printing, traces, stripes (sometimes on both sides of the lane). The extension of condition monitoring and process control are to reduce maintenance costs, increase productivity and improve product quality. We study the vibration in most important parts of Cold rolling mills . This phenomena causes severe damage for mill machine and strip quality. The integrate control process is made to analyses the vibrations who is produced on the work roll chocks and backup

roll chocks. The noise and chatter signals is carried out in the time and frequency range. The noise has to be eliminated to obtain reliable strip quality in conformity with predicted dimensions. At long term we can create a database used for compare between a initially signal and a work signal and finally to archive a quality standard for each strip. In a parallel system we made a compare between the initially torque and the torque in time of the rolling process. The purpose is to diagnose the state of the mill machine and predict when some parts of mill machine can damage. The accuracy of the thickness sheets (texture or surface roughness) is important for the beneficiary of this product. In work conditions vibrations or oscillations may occur, which again cause gauge chatter or chattermarks on the rolling sheet. Gauge chatter are periodical faults in thickness or shape of the strip or regular shades on the surface of the strip transverse to the rolling direction. Heavy vibrations of the roll stand may even cause ruptures of the strip (cf. Figure 1) /The amplitude and wave length of periodical strip faults depends on the vibration system and the vibration frequency.

Figure 1. Strip deformation due to rolling mill vibration

Free vibrations occur when a single trigger pulse affects oscillatory systems. At the trigger pulse (impact) the rolling stand or parts of it oscillate with their own natural frequency.

Separately and parametrically excited vibrations in rolling stands are in general the direct effect of deficient plant or process conditions or alternatively of plant damages, such as for instance when the roller lock, the roll bearings or the drive train have too much play. An other cause are periodically changing system parameters (e. g. variation of controlled

- With low frequency (of the order of 5-90 Hz);
- With frequencies of the order of 100-300 Hz;
- With frequencies of the order of 500-700 Hz.

Each of them (Referring to frequencies) affects the other functionary system.

From the comparison of experiments and theoretical aspects with the results of their measurement we can say that :

Spectrum vibrations for the frequency range of 100-300 Hz is well highlighted in the graphs presented in Chapter VI and comperabil (amplitude, frequency) to those specified in the previous chapter;

- Vibrations in the range of 500-700 Hz frequente no relevance (with effect) significant compared with Chapter V.

Appearance flaws specific tape rolled - in the experiments carried out - is due to vibrations contained in the range 100-300 Hz. In table 1 and 2 are highlights some of the causes of the emergence of Vibration (100 Hz ranges and 500-700Hz), a recording - assessment and mitigation measures (elimination).

Table 1 A. Vibrations in the range of frequencies 100-300 Hz

No Crt	**Production vibrations - causes**	**Recording Mode (Rating)**	**Measures to mitigate - remove**
1	Irregularities and deformation of the cylinders work	It measures the profile cylinders working.	Changing cylinders working (possibly improving correction)
2	Failure rolling bearings camps cylinders working		Changing rulmentiolor Unfair
3	Clindrii support waste.	Models wear on the surface of cylinders	Changing cylinders support. Inghiulara positioning of cylinders (support - so) depending on excentricitatile diameters.
4	Low temperature of the oil		Increase oil temperature. Reducing the

	camps cylinders support		cylinders sarciii support
5	High temperature at the entrance lane in tandem millle laminorului		Growth in output voltage. Reducing tension in the entrance millle tandemului.
6	Variations of tension in the band entry-exit lane of mill	Measuring blood pressure, according Frequency response	Control parameters: deformation, rolling speed, tension in mill.
7	Inadequate emulsion (also in excess surface band)	Checking parameters emulsions	Checking the composition of emulsion stability. Replacement.
8	Print non-rolled strips on the surface.	Vibration testing with and without tape	
9	Sudden changes of speed rolling	Measurements of parameters	Tahnologici optimization parameters for the functioning without trepidatii
10	Switching end welded strips of the cylinders work		Reduce speed rolling
11	Discounts excessive thickness of banzii - to mill		Decreasing the amount of reductions on crossing
12	Entire Vibrations due milli		Reducing its components games
13	Depreciation poor - vertical - the effects of load		Presurizarea balancing system of cylinders support. HAGC System

On the monitoring system "on line" proposed for a tandem rolling mill with five mill (1700mm) band Cold. - Self-starting oscillations result from the interaction of various process parameters in connexion with the simultaneous supply of power to maintain the vibration process. What is known as the third-octave chatter of rolling stands, can be put down to self-excitation.

Table 2 B. Vibrations in the range of frequencies 500-700 Hz

No Crt	**Production vibrations - causes**	**Recording Mode (Rating)**	**Measures to mitigate - remove**
1	Irregularities of deformation of the cylinders work (including table)	Masoaraprofilul cylinders are working.	Changing cylinders working (possibly improving precision correction)
2	Failure rolling bearings camps cylinders working		Changing the rolling bearings with defects.
3	Wear decks cylinders support	Model wear observed on board cylinders support	Note prijin cylinders. It positions with a certain rotation Angular cylinder superior support from the bottom. Modulation speed rolling
4	Banda printing due to vibrations from the LBC		“Inconsistent” Rolls (Non rolls)

Classification of vibrations in rolling mills according to the frequency:

- vibrations vertical to the roll stand, roll stand-vibrations:

- torsional chatter, torsional vibration of the main drive:
- gage chatter or third-octave chatter:
- roll chatter or fifth-octave chatter:500 Hz or higher

The aim of the research program developed over a period of cca.7ani, was to minimize the effect that we produce vibrations of the rolled strips - used in manufacturing auto parts, industrial 5 Hz to 20 Hzequipment, household appliances, was to 100 Hz to 300 Hz and the components of tandemului lamination.The aim of the research program developed over a period of cca.7ani, was to minimize the effect that we produce vibrations of the rolled strips - used in manufacturing

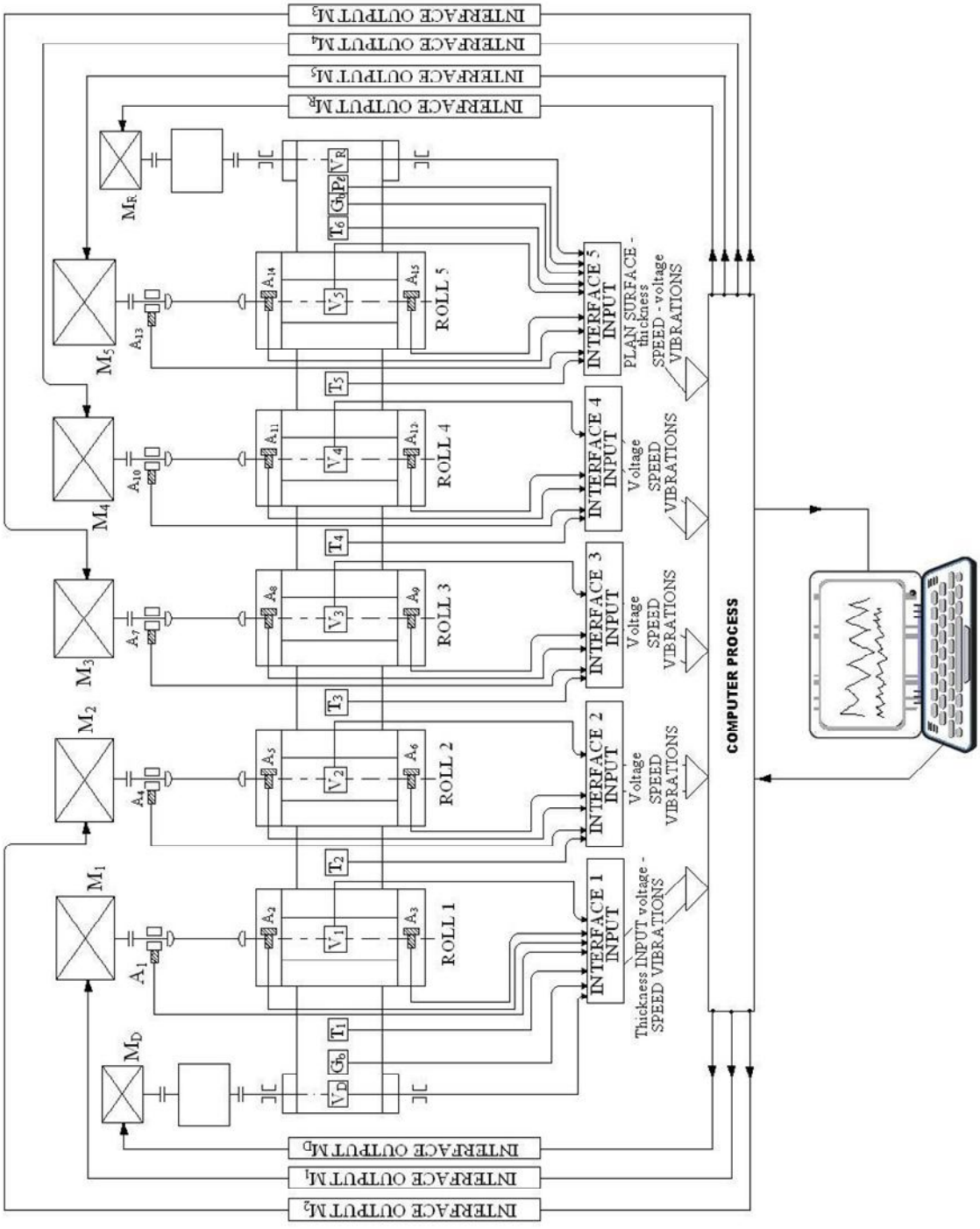

Figure 2. Originally, alarm and monitoring of rolling mill process.

On the basis of the monitoring system proposed experiments that were conducted in laboratory experiments but, more importantly, measurements and tests - rigorously in the rolling mill process, using performance-type devices Bruel & Kajaer, Labview programming interfaces process input-output signal, transducers, filters, amplifiers, signal, transducers of speed and torque.

The alarm-monitoring "on line" proposed and accepted (Fig. 2) - to become operational soon to LBR - 1 - is a computer component pincipala process with a role in filtering, Identifying and analyzing (comparison) signals received through interfaces-entry and reporting them to the size of signals characteristic state laminorului (repair quarterly, annual, capital), followed by analyzing the frequency of signals received and transmitted signals received operative and operative transmission of signals regulating - through interfaces Output - which will decrease or increase depending on the case of rolling speed, tension in the band.

Increase or decrease the speed of rolling in correlation with tension in the band, rolling force reductions in the passages (mill) is based on the frequencies to each recording vibrations in tandem caja. Frequencies between 12-50-110 Hz, occurs when there are failures in the system of training (camps, clutches, gears games illegal in-couplings, motor etc.).

Frequencies in the range of 125-260 Hz, characterized the occurrence of sudden variations in thickness-planeitate for laminated tape.

Frequencies in the range of 500-850 Hz, the land provoaca ribbed cylinder capacity of working-support, which is printed on the surface strip rolling.

It is necessary for the monitoring system proposed converting analog signal in the digital signal to facilitate the submission of-understanding-interprezentarea by the operator. On display will monitor this:

Vibration levels depending on the speed and tension in the band for the 5 mills in tandem; - For each mills in tandem will be displayed signal vibration in the system dynamic (rolling) and will compare the vibration signal is put into operation (after RI, RA, RK) may monitor the behavior and state-of cylinders support, the state camps (or MORGOIL bearings), into rolling part gap- and last but not least to avoid breaking the lane with negative consequences for manufacturing laminate.

2. CONCLUSIONS

Analysis tasks arising from the rolling flat products, the main parameters constructive-functional, is particularly important in the context of the new requirements of modernization for lines thin strip product . In conditions which do not take into account the effect of varying tasks, and in particular of the dynamic errors appear to making machinery components, with repercussions all over the reliability and quality production. In practice, the different interfering frequencies into those which are proportional to the speed and those which are not are the first step in describing the phenomenon of vibration and its manifestations (s. below).

Causes of speed-proportional incitations (a.o.): material pre-damaged by roll/gage chatter polygonal roll shape (rotundity error) due to vibration of the roll grinding machine balance error and eccentricity of the rolls roll bearing and tooth error drive irregularities, e. g. due to displacement of shaft

Causes of speed-independent incitations (a.o.): natural vibration of the roll stand self-starting oscillations of rolls vs. roll gap fluctuation of front tension non-homogeneity of material slip effects (stick-slip) drive vibration (e. g. drive regulation)

chatter marks due to excessive free motion (e. g. locking or hit)

The vibrations observed in rolling stands can also be classified in accordance

In the researcher made was the following:

1. Under the action tasks variables (interior and exterior system), the chain of cinematic equipment to distort, charging the forces and resistance of the materials from which they are made the components, by installing the phenomenon of fatigue. This is the most frequent cause of the deterioration of equipment subassemblies.

2. Main sources demands are dynamic forces of inertia period starting and braking; games in components from inside the spaces of the cinematic chain entrapment -working; wear subassemblies; faulty execution and assembly.

3. For a band mill tandem cold five mill - 1700 mm - measured dynamic couples have values exceeding the dynamic when calculated with about 17% to mille I, II, and approx. 23.5% to mille III, IV and V. These differences are based on the following: the shock due the clamp lane between rollers; games due to components usage chain training, inadequate emulsion; games related positioning system; the usage of the decks cylinders; hardening band;

4. In terms of share of dynamic effects for Milwaukee tandem studied, can appreciate that the most important dynamic in the first mill in tandem, is mainly due to the positioning system, with usages related, and for the last mill (III, IV, V) cinematic entrapment chain of motor-couplings bare-coupling, emulsions, lane

5. In order to optimize the reduction, speed, voltage, strengths, to obtain a non-uniformity minimum length of the thickness of rolled strip and in correlation with a control system for rolling vibrations of tandem (by adjusting the system of continuous feed-back scheme speed-tension), we designed a mathematical model of their own. It is based on dynamic response of the structure of all the rolling, depending on the characteristics of inertial, elastic and depreciation of the structure.

6. The most important tasks from dynamic imbalance cylinders, the coupling bars, couplings, deformation of componenetelor, wear. Tasks can become dangerous subjects, both by the amplitudinii, and because passing through zero, which can cause amorselor Cracking followed while breaking all the components of the rolling.

7. For the quarto mill were delimited three major causes that can induce dynamic effects resulting vibrations through the appearance-time of the complete operation, as follows: the blank that rolls and impose certain requirements that the technological process, related to speed, strength, reductions, tension was; the mill itself by rolling through the camps positioning-camp-slide-cylinder-window frame; chain of cinematic entrapment by couplings-bearing-bars-coupling sleeves or universal couplings.

8. Vibrations in the milllor of rolling strips of lead: geometric configurations and dimensions do not comply with standards for bands rolled, affecting the quality of surface band; tensions variables intermill; tasks patchy in some parts of milli and chain of cinematic antrenarii, followed by destruction, including functionatii the resonance.

9. Own vibrations of rolling are based on the following causes: high tensions between mill; high speed rolling - over 1150 m / min or variations thereof, low coefficient of friction between band and rollers work; unsatisfactory state of decks cylinders working; Use of emulsions of poor quality or in excess, crossing heads welded strips of the cylinders; twisting vibrations from the training of cylinders; games due to vibrations of camps, couplings, transmissions, gears.

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