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# ANALYSIS OF THE LATERAL EFFORTS IN ASYMMETRICAL LONGITUDINAL ROLLING

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**ABSTRACT**

This paper presents the variation module of lateral effort according to the difference between the working diameter of the rolls and the working direction of the side efforts in the case of asymmetrical longitudinal rolling.

At the same time it contains an analysis of the peculiarities that are transmitted in the rolling process.

**KEYWORDS**
efforts, lateral, rolling, asymmetrical

## 1. INTRODUCTION

Any well managed operation of rolling needs a precise determination of the force factors. It is a complicated problem, to solve it means knowing the basic rules of process of plastically deformation of metallic materials, generally, and also to know the physical and mechanical characteristics of the mentioned materials.

One knows that the efforts applied to a metallic material during its plastic deformation are conditioned not only by its properties, but also by stress status applied to it.

The metal material deformed between the rollers of rolling mill suffer high compression stress due to the action of the rollers, and it also bears tangential surface tensions because of the friction between the rollers and the metal material.

In spite of the great number of theoretical and experimental works regarding the classic operation of mechanical deformation between equal diameter rollers, there are not enough clarified many issues regarding the physical and mechanical nature of the transformations that appear in the metallic material during its plastic deformation.

In the Romanian and international theory of rolling it is usually analysed the plastic deformation between rollers of equal diameters, even if this operation it is first an abstractisation compared to the real conditions of the rolling, for there is actually a certain difference between the diameters of the work rollers, and sometimes the rolling mill is made having unequal diameter rollers.

## 2. RESEARCH METHODICS

The research for this theme purpose have been made on a 170mm reversing two-high rolling mill, created and installed in the no conventional technologies and plastic deformation laboratory of the Engineering Faculty from Hunedoara.

An experimental installation formed of: special construction rollers, bearings, punctiform captors for lamination pressure, lamination forces captors and lateral pressure captors it was created for research in condition of technological similitude symmetrical and asymmetrical process.

In figure 1 it is presented in overview the mentioned installation, with the way force captors are assembled in order to determine the lateral efforts in the longitudinal asymmetrical lamination but also to show the author's contribution regarding method of experimentation.

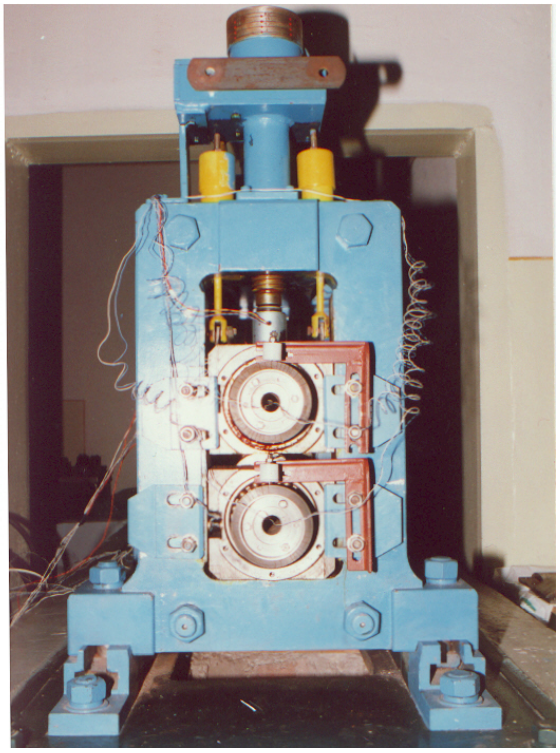

***Fig.1.*** *Montages punctifom captors for recording the lateral efforts*

The bearing holders of the inferior roller were modified for recording the lateral efforts so that the respective captors could be installed incorporated perpendicularity on the bearing' s axis.

On the surface of captors were stuck tensometric stamps bound in deck, stamps that modify their dimension under the action of the effort to be measured. These dimensional modifications of tensiometer stamps are generating variations of their electric resistance, that are proportional to the deformation efforts and the measuring of the forces is limited to the measuring of these resistance variations.

Usually, the tensiometer stamps of a forces captor are bound in deck. The deck has on a diagonal it is measured a electrical signal – proportional of the applied effort – and for recording of the measured values this signal is recorded by an oscillograph.

The oscillograph is a the type N-700, having 14 channels, the impulses on recorded are a scale of 120 mm width, heaving 4 cm/s moving speed of the paper band.

Through experimentations between rollers of equal diameters we where convinced that galvanometers conectated to the electric scheme of captors from inferior bearing holders for the seizing of the appearance of lateral efforts, these galvanometer give on the paper band of the oscilograph line of zero.

In the place of segments for the symmetrical process, with $\frac{D_s}{D_i} = \frac{170}{170}[mm]$, we installed segments for asymmetrical process, with $\frac{D_s}{D_i} = \frac{140}{200}[mm]$. With respective punctiform captors repeating the experimentations for variant of lamination between rollers of unequal diameter.

This time, according to the characteristic oscillogram they noticed big enough lateral efforts having a value that vary depending on the thickness of the samples and on the applied reduction.

The respective values, obtained from the processing oscillograms recorded and presented in the form of curves X=f(ε) in figure 2 which a matter of fact represent only parables with the peak at the beginning axis of coordinates and which are growing in the same time with the thickness of the laminate sample and of the decrease degree.

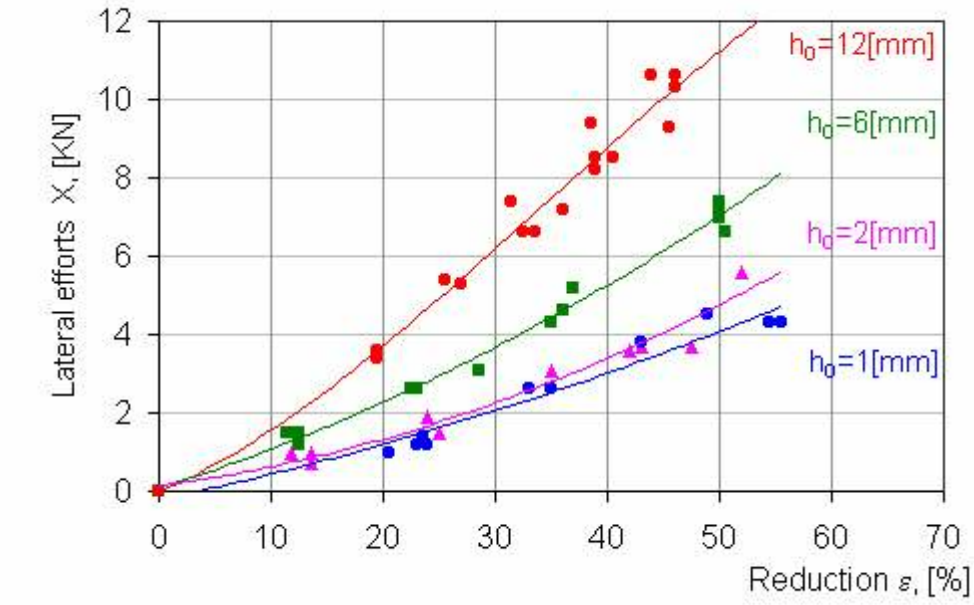


***Fig.2.*** *Dependency lateral efforts of decrease, to the lamination samples from aluminum of different thickness, between operates rollers of unequal diameters* $\left(\frac{D_s}{D_i} = \frac{140}{200} mm\right)$

It is obvious that the samples lamination of same thickness between rollers of unequal diameters, the value of lateral efforts grows with growing of the differences between work diameter rollers.

The explanation of this phenomenon consist in continue increasing of the "φ" angle in the same time with the growing at the "*a*" arm (see figure 3). This may be described as differerence among "$a_s$ "and "$a_j$".

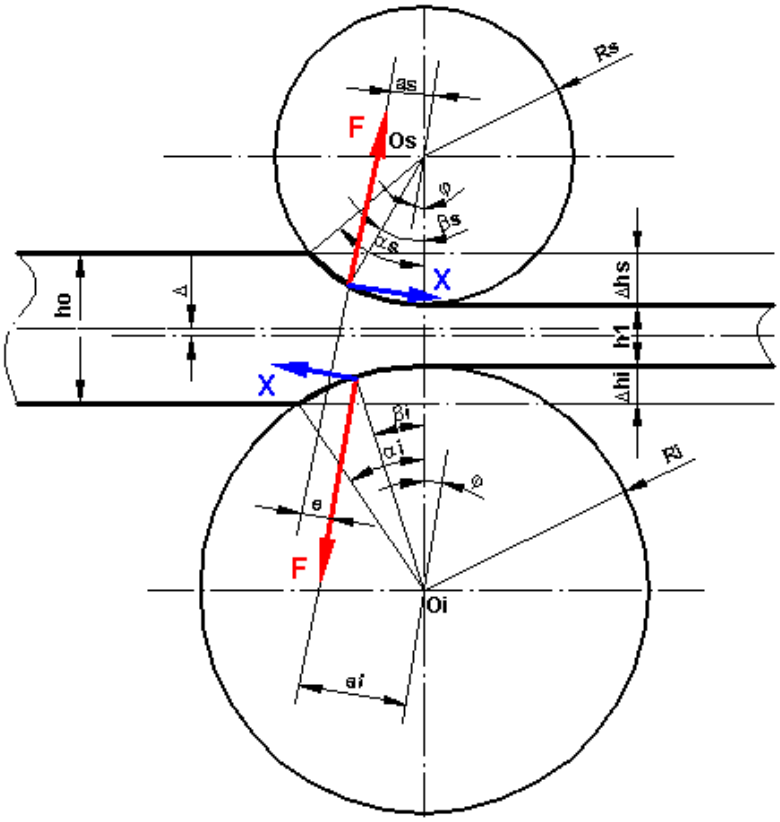


***Fig.3.*** *The resultance arms of pressure ($a_s$ and $a_i$) and direction of lateral efforts(X), to lamination between unequal diameters in operated roller.*

The value of lateral efforts which appear to the lamination between rollers operated by unequal diameters it is modified by the curve factor of the roller's segments and the different periphery speed factor.

It can be noticed the influential factors of peripheral different speed, which on chart it is represented by the discrepancies between the curves $X=f(\varepsilon)$ for same laminate thickness by analyzing both the dependencies $X=f(\varepsilon)$ obtained for the lamination between rollers of unequal diameters when both rollers are operating and the variant when the superior roller of less diameter is in operating (fig.5).

The lateral efforts, which appear in the lamination between roller operating by unequal diameters, these efforts are equal on the side of the superior roller (less) on inferior roller (bigger).

The experimentations effectuated confirm the rightness of the schemes of actioning of the forces proposed by the specialty literature.

To clarify the direction of operation of the lateral efforts great numbers of samples were laminate.

Captors for the lateral efforts recorded the presence efforts of only in the cases when captors took over the action against the senses of lamination.

On experimental way it was clarified that lateral efforts from smaller diameter roller (superior) are headed on direction of lamination, and from bigger diameter roller (inferior) the efforts are headed against the lamination direction.

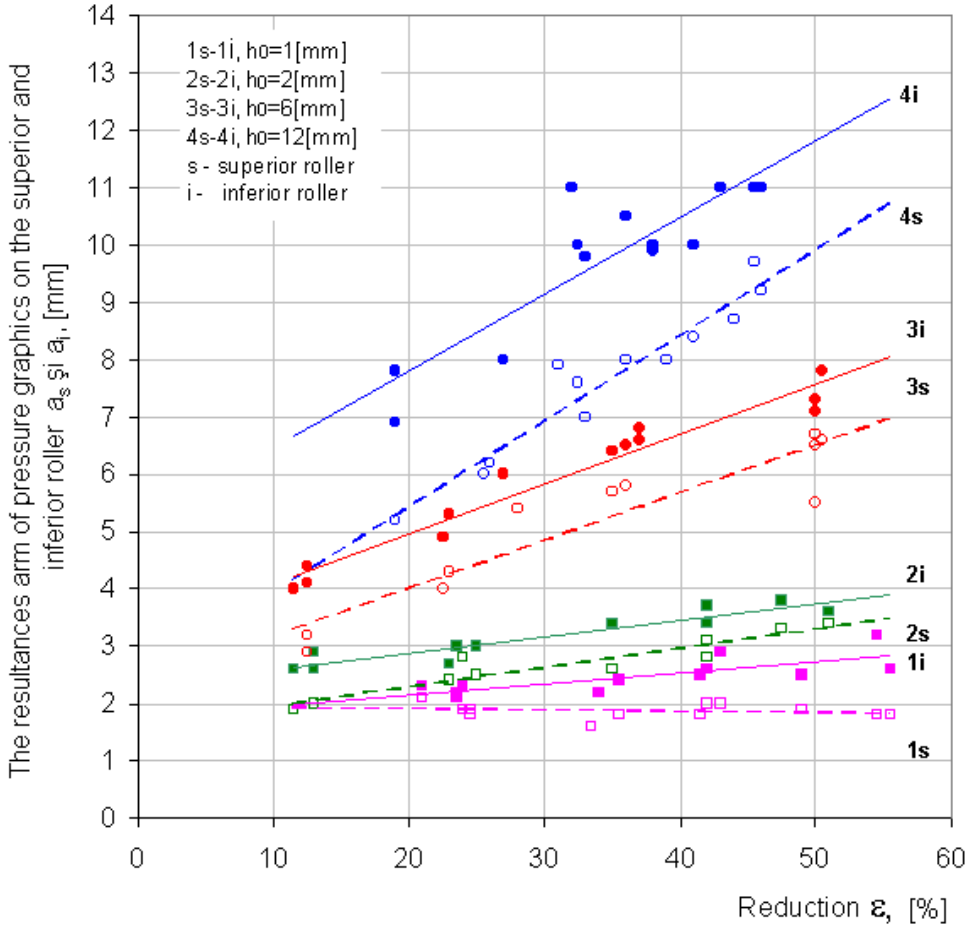


***Fig.4*** *The dependence of the resultance arm of pressure graphics on the superior and inferior roller, reduction function, in aluminum laminate samples of different thickness between rollers of unequal diameters* $\frac{D_s}{D_i} = \frac{140}{200}$

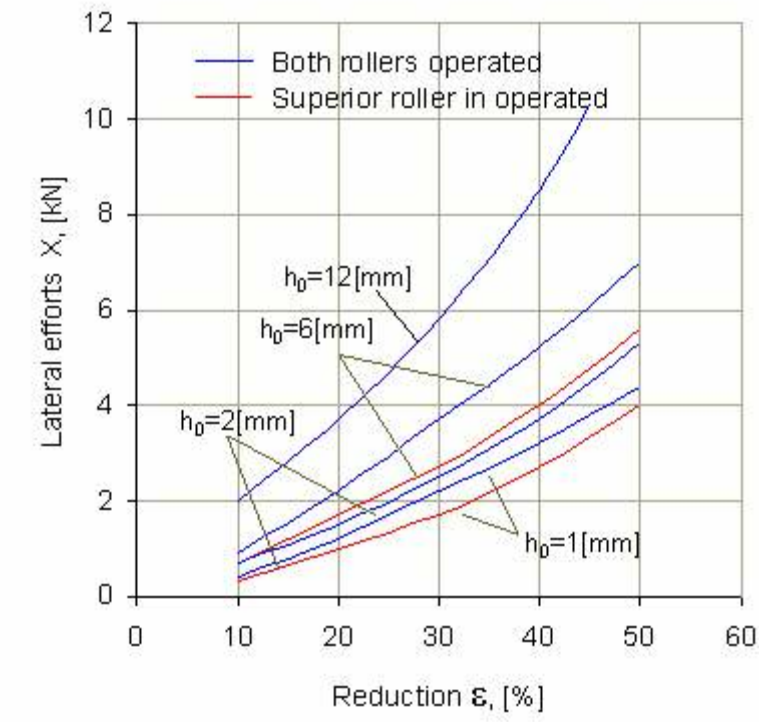


***Fig.5.*** *The dependence of the resultance arm of pressure graphics on the superior and inferior roller, reduction function, in aluminum laminate samples of different thickness between rollers of unequal diameters*

$$\frac{D_s}{D_i} = \frac{140}{200}$$

## 3. CONCLUSION

- the lateral efforts, who appear to the lamination between operates rollers of unequal diameters, is favorizate to the differences factor of curvature because the rollers have unequal diameters and the factor of peripheral speed is different.
- the lateral efforts influence favorably about allocation pressure on the surfaces of contact, action in analogous to mode the adhibition previous drawing the posterior and anterior. This influence is intensified along with breed the thickness samples laminate reduced relatively.
- he established as size lateral efforts result to lamination, when one of the rollers is inaction, he don't depends on the difference among the diameters of thing, because in this variant the which factor look the peripheral different speed, absent ones.

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