NUMERICAL AND EXPERIMENTAL METHOD TO ALIGN 2500 TF PRESS COLUMNS

DOBROT OANA-MIRELA[1*], ŢOCU FLORENTINA[1], MOCANU COSTEL IULIAN[1]

[1] *"Faculty of Naval Arhitecture" University of Dunarea de Jos, Galati, 47 Domneasca Street, 80001, Romania.*

Abstract: To realize the standardized profiles is using special machines. These special machines are presses which makes the cross section profile by drawing a semi mould. This paper presents a method to align of guide columns press of 2500 tf. Was used a numerical model software, specialized in finite element analysis FEM, Solid Works COSMOS/M. Meshing was done using SOLID volume elements, resulting a total of 39000 elements.

Keywords: press, method for align, stress/strain, FEM

1. INTRODUCTION

Metal constructs are made of profiles, which generally are done in many ways:
- Elements joined together by welding;
- Elements joined together by riveting;
- Cold and hot shaping (extrusion and / or bending).

To realize the profiles made by extrusion it is used presses which mainly they have hydraulic drive. Profile results by drawing in moulds. Drawing forces are depending by profiles type and dimension which must achieve. In general, these machines are composed of: Support, Column of guide, Port matrix, Piston which makes drawing force, Hydraulic system to achieve drawing force.

Presses that achieve great forces usually have the frame and guide columns very height. When is installing these devices are necessary special align operations because of large scale. Missing of these operations lead to block the blanks in mould, with uncontrolled curves cross sections, etc.

This paper presents a numerical - experimental combined method for align columns of steerage of presses. The subject of study was 2500 tf press from Laromet SA Brasov. This press is shown in Figure 1 and used to realize by drawing metal profiles. In order for align columns of steerage go through some steps that are designed and described below.

* Corresponding author, email: oana.dobrot@ugal.ro

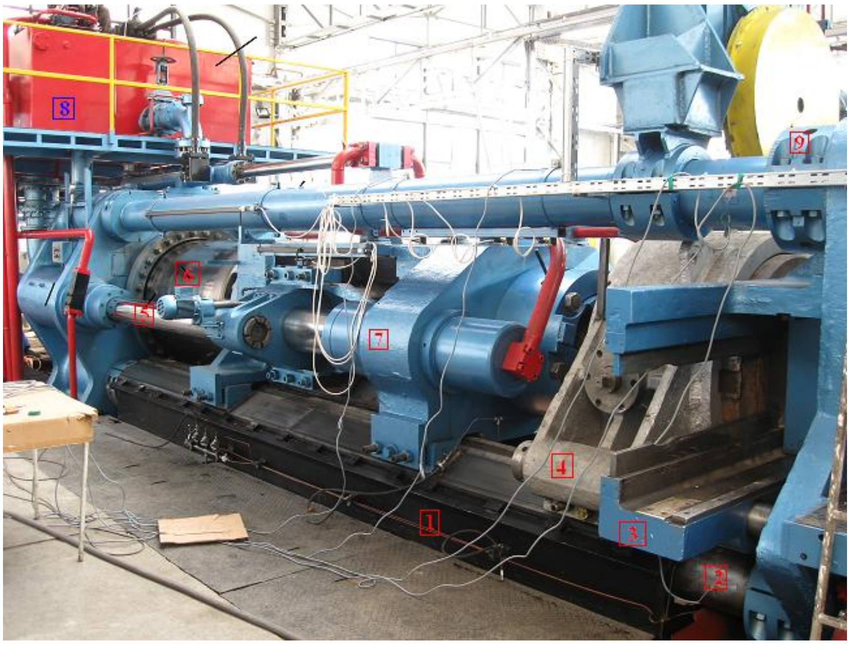

Fig. 1. Constructive elements of the press: 1- support; 2- guide columns – four pieces; 3 - end piece; 4 - mould base; 5 - guide columns at the system which is realize the drag force; 6 - piston which is realize the drag force 7 - clamping system blank; 8 - hydraulic system action; 9 - adjustment nuts.

2. NUMERICAL MODEL FOR ALIGN GUIDE COLUMNS

In order for align guide column was necessary to achieve a numerical model. With this model, we determined the maximum stresses and strains from directions columns.

Was used a numerical model software, specialized in finite element analysis FEM, Solid Works COSMOS/M. Meshing was done using SOLID volume elements, resulting a total of 39000 elements. Load was applied to a circular area of 1.16 m diameter. This is the piston diameter (Figure 1 position 6) which makes pull power. The numerical model is presented in Figure 2. The model is very schematic presented because it wasn't interested what happens in other parts of the press, it was interesting to see the tensions which appear in press columns of guide.

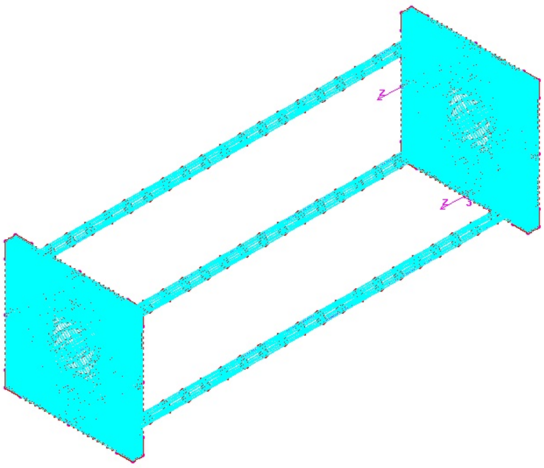

Fig. 2. The meshing model with volume elements.

Because of large size of end plates and columns were meshed using the volume elements. It has chosen this way to model the press structure, because these elements are massive and the sizes are comparable in all three directions.

Loading tasks are considered as being composed of:
- Own weight;
- Clamping force is obtained by pressing the system formed from 5, 7, 4 and end piece 3.

The model was loaded with forces corresponding the test pressures of 80, 145, 210 bar. In Figure 3 it shows the variation of stresses, strains (at larger scale) that appear in columns of guide.

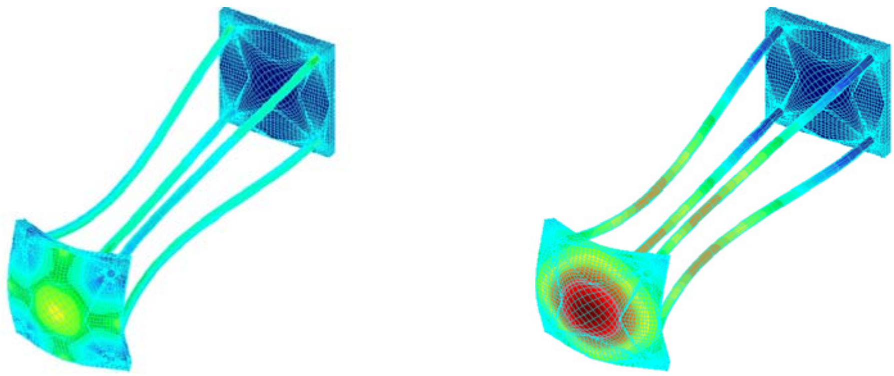

Fig. 3. Stresses, strains variation (at larger scale).

3. EXPERIMENTAL SETUP

3.1. Execution of align guide of columns

For align the guide columns presser of 2500 tf was used resistive Electrical Tensometry (RET). This method of measuring is based on the transformation of mechanical deformations changes in one variation of electrical quantities:
- Mechanics – columns deformation;
- Electrical – resistance of an electrical conductor.

As a transducer for mechanical measure it was used the resistive transducer. This resistive traducer is consists in a metallic wire disposed on a support insulating. The Resistive Electrical Tensometry method was chosen because of two important advantages:
a. provide good results;
b. relatively low price cost.

Of experimental methods for determinate the state of stress with remarkable result as accurate and provides good yield and relatively low cost is the Resistive Electrical Tensometry (RET) using strain gauge [1].

RET is the method of measuring deformation and elongation of a solid body, by means of transducers which transform mechanical deformation changes in variations of electrical quantities. The resistor is bonded to a substrate or embedded in the medium (plastic or paper). Because it has dimensions small, resistive transducer is called strain gauges or stamp strain gauges.

The transducer is glued piece of research in order to follow its deformations. To achieve an accurate measurements, in electrical strain gauges is used to bridge the transducer assembly, is difficult to measure with sufficient precision with ohmmeter resistance. The simplest type of assembly is the Wheatstone bridge.

Were used resistive transducers strain gauges and classic Spider 8 device purchase measured data [2]. To determine the strain state were established four measuring points located on the columns as shown in Figure 4. These measurement points were chosen only from the easy viewpoint mounting of resistive transducers, taking into account that the load is axial.

Fig. 4. The four measuring points on the columns.

The bonding strain gauge transducers were done with special Z70 glue (Hottinger). In every step was checking the transducer resistance and breakdown/crossing resistance. It hasn't been made the protection against mechanical and atmospheric factors because the adhesive is not affected by moisture after drying.

The measured signal acquisition system is composed of:

- Spider 8 bridge strain gauge (four channels);
- IBM Laptop with specialized software from Hottinger, Catman Express 3.1.

The align column directions were followed:

- To obtain the equal normal stresses approximately in the four columns of guide;
- The tensions from columns have values close to those calculated experimentally;
- Not be further than admissible normal strain in columns which is 324 MPa.

Align guide columns was achieved by a number of iterations. Were made it measured to determine the specific deformations and calculating then the normal stresses. Since at the beginning of align columns operation were obtained differences results the procedure has been restored (screwing / unscrewing fittings nut 9) until were obtained tensions approximately equal to those calculated.

It was had consider at every step to realized of certain forces as close to the corresponding functioning system. The maximum pressure corresponding to functioning system, taking into account the maximum power of 2500 tf is 236 bar. In testing to guide the align column was not exceeded this pressure. The maximum test pressure was 210 bars which correspond to a force of 2218 tf.

The request which take birth in columns is an axial load [3].The stress/strain which appears is normal stress and is calculated with the next equation:

$$\sigma = \frac{N}{A} \quad (1)$$

where:

- σ is normal strain which appear;
- N axial force made by raising/ detachment nuts;
- A cross-sectional area of the tyrant.

Specific deformation values are obtained experimentally and viewed using laptop from the experimental system. With specific deformations obtained experimentally, were able to calculate the normal stresses using Hook's relation:

$$\sigma = \mathrm{E} \cdot \varepsilon \qquad (2)$$

where:

- E elasticity longitudinal modulus of steel which are made columns: $E = 2.1 \cdot 10^{11}$ Pa;
- ε measured strain.

After equilibrium the columns it was made control samples for verification align. These samples it was made repeat of 5 times, averaged results being presented in Table1.

Table 1. Normal stresses in the guide of columns press.

		CALCULATION		MEASUREMENTS			
		$\sigma = \frac{N}{A}$	Numerical				
Pressure	Force	Column	Column	Column 1	Column 2	Column 3	Column 4
[bar]	[MN]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]
80	2.113	8.31E+01	8.42E+01	8.23E+01	8.37E+01	7.98E+01	7.84E+01
145	3.829	1.51E+02	1.59E+02	1.58E+02	1.62E+02	1.48E+02	1.49E+02
210	5.546	2.18E+02	2.20E+02	2.24E+02	2.38E+02	2.08E+02	2.18E+02

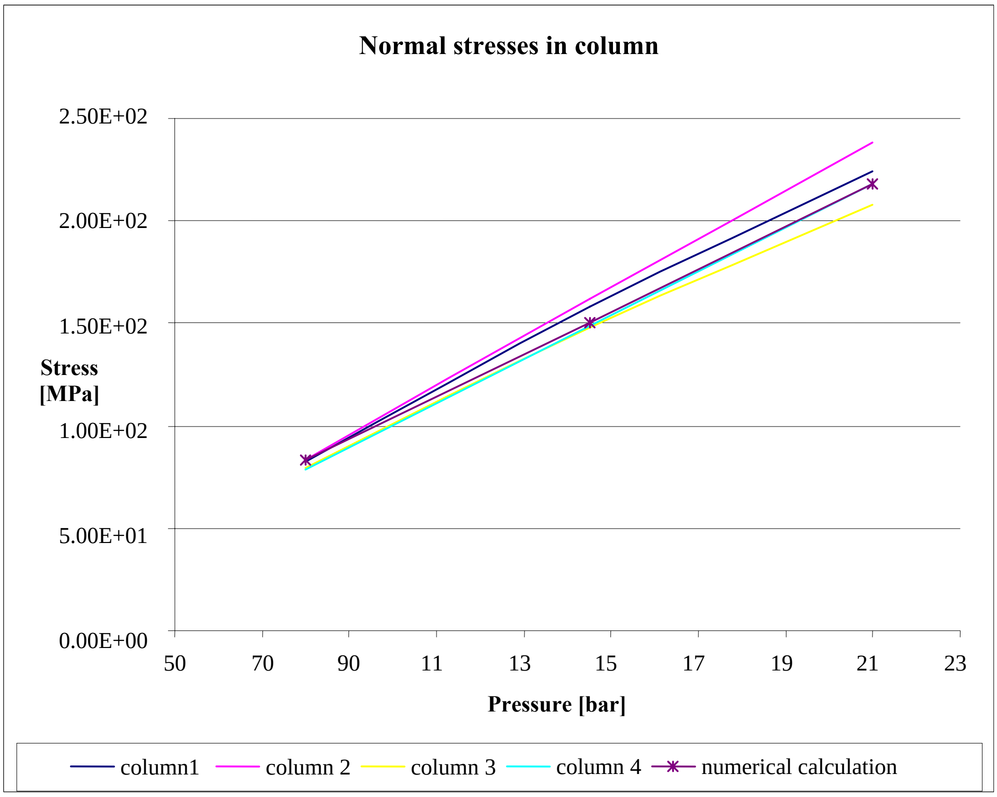

Fig. 5. The diagram of deformation from the columns.

4. CONCLUSIONS

The results of analysis numerical calculation and after align columns guide (Table 1 and Figure 5) results:
- The normal tension values obtained numerically and experimentally are similar. These values obtained numerically and experimentally, offer the producer, the safety and quality of profiles executed;
- The methodology used is well selected being relatively easy to apply with minimal equipment;
- The method applied can be used to check in time the align guide columns to prevent losses in the process of drawing performs;
- The methodology chose for align the columns guide not exceeded during operation will ensure normal tension levels.

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