STUDY OF MATERIALS FOR BRAKE DRUMS

MIORIȚA UNGUREANU[1], NICOLAE UNGUREANU[2], ACO ANTI[3]

Abstract: The paper presents the analysis of stress and deformation for two types of materials that can be used for brake drums, components of cranes**.**

Key-words: tensions, deformations, pressure, of the contact, drum

1. INTRODUCTION

The study refers to break type FC400 of crane. In time of operation of crane the normal cycle presume numerous braking periods. The process of braking presumes interactions between the brake shoes and brake drums. The interaction is accompanied by tensions and deformations of the drum brake.

In the first stage of research we performed three-dimensional model of brake. The research was made for brake type FC400 (Fig. 1) which equips the lifting system of an overhead crane with the following characteristics: drum brake diameter: 0,4 m, drum width: 0,14 m and corresponding contact angle at the centre of the brake shoe and the brake drum is $60°$. The braking operation is done using an electro-hydraulic cylinder and a system of levers [5].

[1] *Assoc. Prof. Eng. PhD. at Engineering and Technological Management Department, Technical University of Cluj Napoca, North University Center of Baia Mare, Baia Mare 430083, Str. Dr. Victor Babeş, Nr. 62A, Romania, Tel: +40 262 218922, Fax: +40 262 276153, E-mail: m_ungureanu@ubm.ro*
[2] *Prof. Eng. PhD. at Engineering and Technological Management Department, Technical University of Cluj Napoca, North University Center of Baia Mare, Baia Mare 430083, Str. Dr. Victor Babeş, Nr. 62A, Romania, Tel: +40 262 218922, Fax: +40 262 276153*
[3] *PhD.Sc., Assistant Professor, University of Novi Sad, Faculty of Technical Sciences, 21000, Trg Dositeja Obradovica 6, Novi Sad, Serbia*

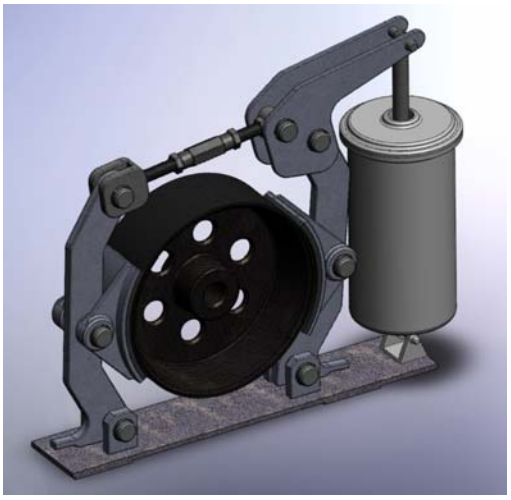

Fig. 1. The braking system type: FC400

2. THE STUDY OF TENSIONS AND STRAINS FOR THE FRICTION COUPLE SHOE-DRUM ITEMS USING FINITE ELEMENT METHOD

Finite element analysis is a tool witch with numerical calculation methods allows determination of structural tensions and strains of technical structures under external forces [3].

Stages of analysis:

- creating a technical drawing three-dimensional of the brake drum;
- importing the drawing into the analysis software;
- preparation the model for the analysis, phase in witch we made the delimitation of the surfaces on which is applied the pressure and we choose the material for the used items ;
- to solve the problem was made automatic definition of finite element nodes and the network structure;
- generating reports.

The analysis was done using SolidWorks software. Dimensional drum drawing was done with the help of the same software. For simplicity were not taking into consideration a number of factors that can influence the process. Among these: surfaces in contact temperature, humidity environment, contact surface roughness, etc.[1][2][4].

Simulation was done for shoe-drum contact pressure of 0,3 MPa. This pressure was applied on drum brake in corresponding areas of brake shoes, bounded with red arrows in figure 2.

The materials chosen for research are AISI 1020 steel and ductile iron. In figures 3-6 are represented the deformations and stresses corresponding.

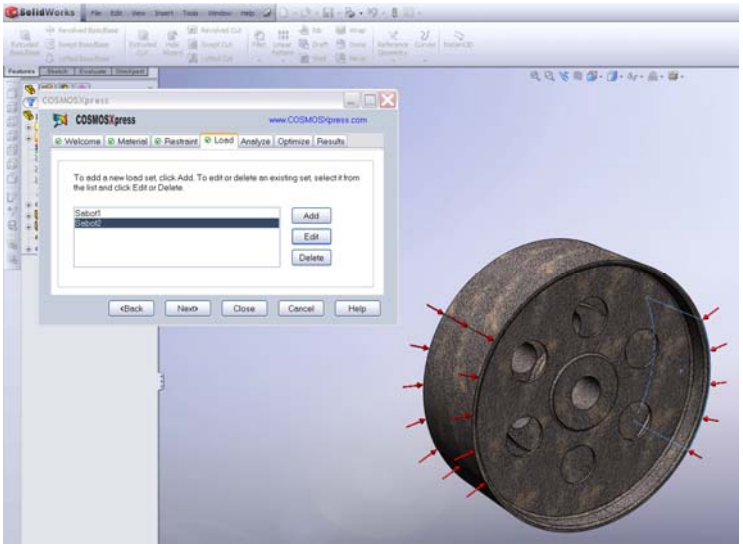

Fig. 2. Delimitation contact surfaces

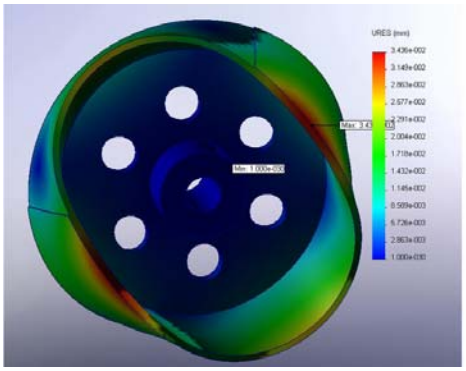

Fig.3. Deformation for AISI1020

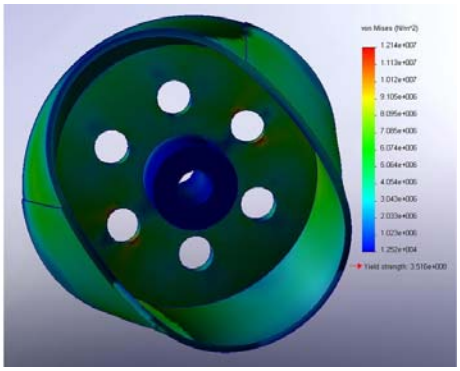

Fig.4. Tension for AISI1020

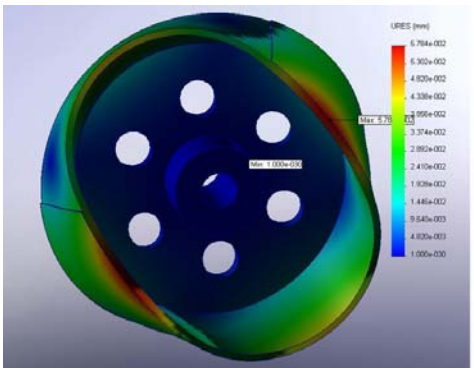

Fig. 5. Deformation for ductile Iron

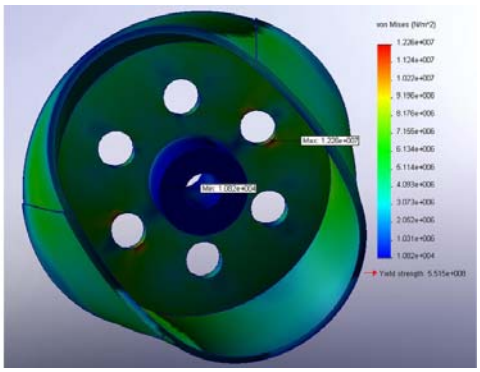

Fig. 6. Tension for ductile Iron

For easy comparison results were introduced in an application Excel (Fig.7).

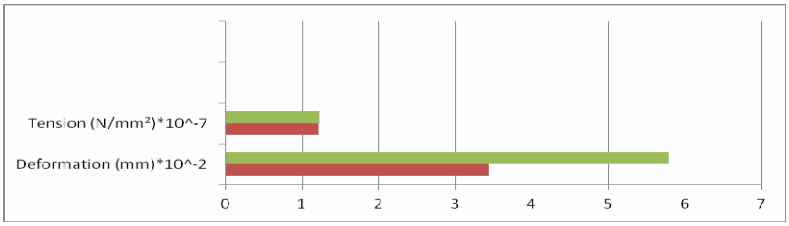

Fig. 7. Deformations and tensionf of the brake drum results in FEA analysis for ductile iron (green) and AISI 1020 (red)

From the view of FEA study of loads on shoe-drum contact pressure, for both materials, results an appropriate safety factor and deformations with acceptable limits.

3. CONCLUSIONS. PERSPECTIVES

The comparison of materials, after the theoretical study presented previous, indicate the next conclusions:

- the tensions for both materials have values close.
- the deformations are different, so for steel AISI 1020 are lower values.

In conclusion, considering the tensions and deformations, the most suitable material for brake drum is steel AISI 1020.

In practice beside the resistance properties of materials that are manufactured brake drums must be accompanied by another characteristic: good thermal conductivity, high friction coefficient between components of braking system (drum brake and shoe brake), wear resistance, etc.

For the future we intend to extend the research with another materials and we intent also to extend the research of characteristics of materials with influence in braking process.

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