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AN ANALYSIS OF THE LOAD EXERTED ON A BEARING-TYPE TRANSFERRING FIXED ON THE FRAME AT THE TOP OR AT THE BOTTOM

ANALÝZA ZAŤAŽENIA TRANSFERINGU LOŽISKOVÉHO TYPU V PRÍPADE, AK JE UPEVNENÝ NA RÁM ZHORA ALEBO ZO SPODU

Abstract

A building line is a common type of equipment used in the rubber-processing industry to build radial truck tyres in the semi-automatic production mode. The bearing-type transferring is part of the equipment. The paper presents an analysis of the load exerted on a bearing-type transferring fixed on the frame at the top or at the bottom. The paper also presents results of the stress and frequency analysis of the transferring.

Abstrakt

Jedným zo zariadení pre gumárenský priemysel je konfekčná linka, určená pre štandardnú konfekciu nákladných radiálnych plášťov v poloautomatickom režime, ktorej súčasťou je i transfering ložiskového typu. Príspevok sa zaoberá analýzou zaťaženia transferingu ložiskového typu pri jeho upevnený na rám zhora alebo zo spodu. V príspevku sú výsledky napäťovej a frekvenčnej analýzy uvedeného transferingu.

1 INTRODUCTION

The main production programme in Matador Machinery, a. s. are facilities for the rubber industry which compose 75% of the production in present. It includes also production line for the production of the truck tyres, light-weight tyres and tyres. The line is dedicated for the standard production of the ALL STEEL radial truck tyres 17,5“, 19,5“, 20“, 24“, 24,5“ in semiautomatic mode. The production line NR3 achieves daily till 300 pieces of tyres with two operators. It contains bearing-type transferring, attached to the frame from above (**Fig. 1**).

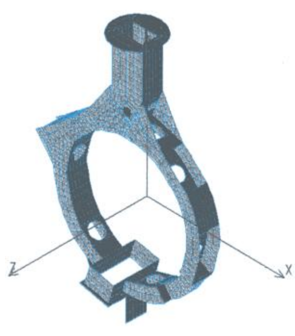

Fig. 1 Bearing-type transferring

Transferring was designed in program Pro/Engineer and then exported like “*.igs” to the program COSMOS M for the creation of the finite-element model. The static and dynamic calculation was made for the loading with

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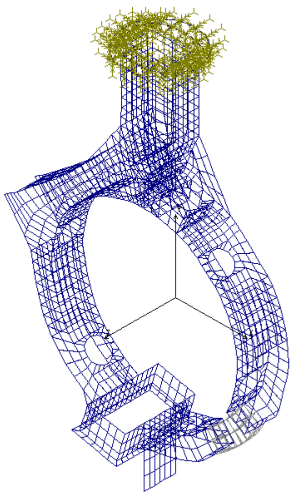
reference to the weight functioning in individual centers. The weight of the individual entities is: entity cast with the cylinders – 137 kg, upper convection – 33 kg, lower convection – 10 kg, grips – 64 kg, cylinders – 30 kg and maximal velocity of the cart motion v_{max} =1 m/s.

2 CALCULATION OF THE TRANSFERRING CONSTRUCTION LOADING BY THE STATIC LOADING

Transferring`s mathematical model was created with fournodal thin shell elements. Stability equations are solved [1]:

$$[K]\{u\}=\{R\} \quad (1)$$

Static analyse of the transferring construction includes solution of the stability equations (1). distribution [MPa]. The transferring computing model is on the **Fig. 2** and tenseness distribution is on the **Fig. 3** in [MPa].



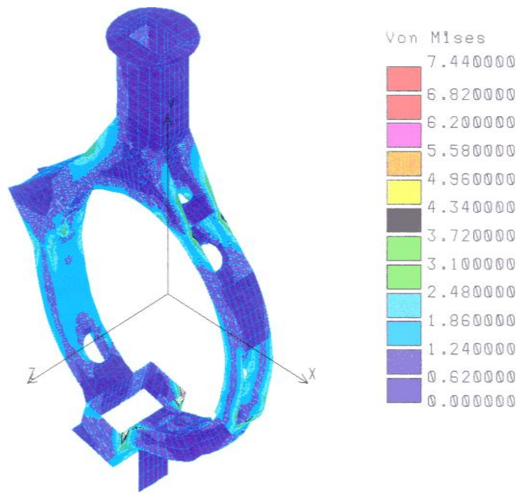


Fig. 2 The transferring computing model **Fig. 3** The tenseness distribution [MPa]

3 THE CALCULATION OF THE NATURAL FREQUENCIES AND NATURAL TRANSFERRING SHAPES

Natural vibration is ability of the system excited by the external impact effect perform harmonic vibrations when the external excitation is gone. This problem is solved in differential equation:

$$[M]\{\ddot{x}\}+[K]\{x\}=0, \quad (2)$$

where *x(t)* is the solution.

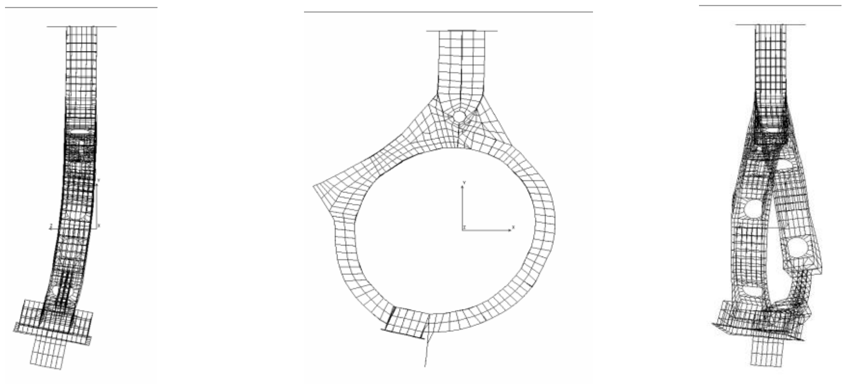
The solution of the (2) should be in shape:

$$x(t)=y\sin(\Omega t). \quad (3)$$

If we substitute it and eliminate trivial solution we obtain the relationship:

$$([K]-\Omega^2[M])\{y\}=0. \quad (4)$$

This relationship is generalized problem of the natural values which solution is made by the semi-automatic-space iterative method. This method is based on the idea of the inverse iteration conversion with several vectors at the same time. On the **Fig. 4** are described the first three natural shapes of vibrations and in the **Tab. 1** are described first 10 natural transferring`s frequencies.



F_Mode=1 F_Mode=2 F_Mode=3

0.877774 Hz 1.3057 Hz 2.14418 Hz

Fig. **4** First three natural shapes of vibrations

Tab. 1

FREQUENCY NUMBER	FREQUENCY (RAD/SEC)	FREQUENCY (CYCLES/SEC)	PERIOD (SECONDS)
1	0.5515218E+01	0.8777742E+00	0.1139245E+01
2	0.8203944E+01	0.1305698E+01	0.7658738E+00
3	0.1347227E+02	0.2144178E+01	0.4663792E+00
4	0.1706904E+02	0.2716622E+01	0.3681042E+00
5	0.2629905E+02	0.4185623E+01	0.2389130E+00
6	0.2662395E+02	0.4237333E+01	0.2359975E+00
7	0.3796545E+02	0.6042389E+01	0.1654975E+00
8	0.3886765E+02	0.6185978E+01	0.1616559E+00
9	0.4973891E+02	0.7916193E+01	0.1263233E+00
10	0.5275567E+02	0.8396325E+01	0.1190997E+00

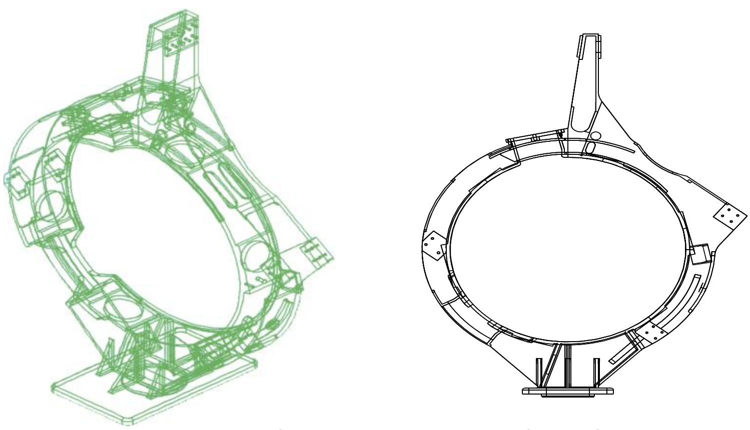
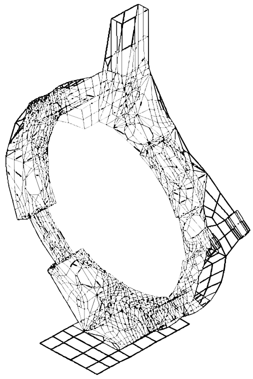


Fig. 5 Bearing-type transferring, attached to the frame from above



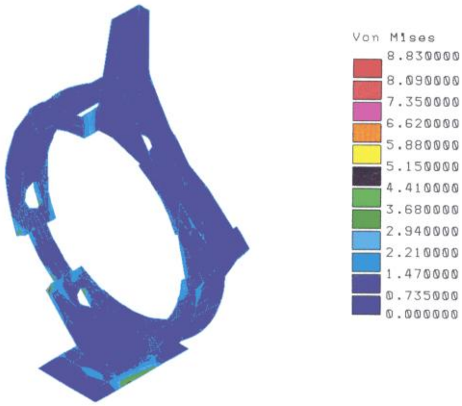
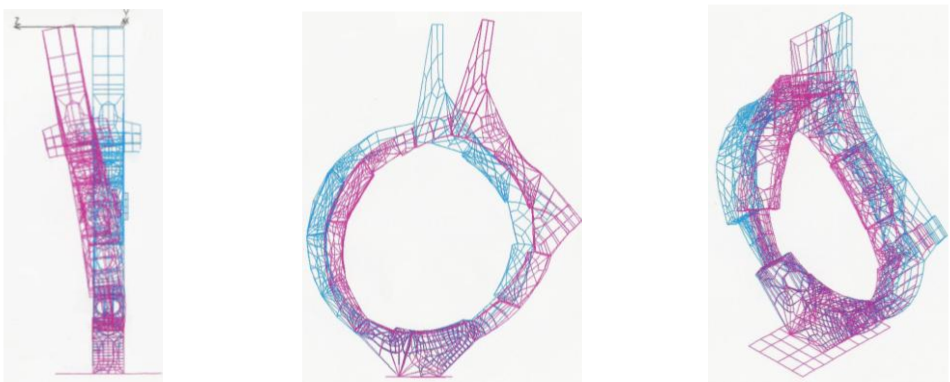


Fig. 6 Transferring computing model **Fig. 7** Tenseness distribution [MPa]

On the **Fig. 8** are described the first three natural shapes of vibrations.



F_Mode=1	F_Mode=2	F_Mode=3
0.617244 Hz	0.915527 Hz	1.62308 Hz

Fig. 8 First three natural shapes of vibrations

4 CONCLUSIONS

Loading distribution on the transferring by the identical loading is much more salutary for gripping from above. Transferring is made of aluminium alloy and it is suitable that it works with sufficient high safety margin.The frequency analyse results, that the first three vibrating shapes can affect transferring work session.

ACKNOWLEDGEMENT

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