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BARROW TYRE PROFILE DEFLECTION

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ABSTRACT: The paper deals with a curvature detection of a wheelbarrow prototype. With the help of line laser profilometer the data in static regime were obtained. Measured data were processed by Matlab®. The displacement in axial x – direction was determined.

KEY WORDS: wheel, curvature detection, data processing

1. INTRODUCTION

The contact-less measurements are in the trend also in a rubber industry.

The works [1-5] deal with the optical measurements of a tyre. With the help of laser scanning it is possible to determine the tread depth of a tyre with a precision of 0.1 mm. The non-contact technique scans the whole tread.

2. EXPERIMENTAL PROCEDURE

2.1 Line laser profilometer

The profilometer is used for profile and width determination of an object, with the help of line laser. The length of laser trace determines the width and length of an object. The apparatus consists of laser module LLP 3-35 (λ = 650 nm), CCD camera CB-3803S and PC. The real setup of the apparatus is shown on Fig. 1. The deformation of an object is given by deformation of front laser wave. The connection between camera and PC is Framegrabber KaApaLAB. It serves for actual image transferring to PC in a real time. The device is helpful for profile determination at rubber, plastics textile materials especially.

2.2 Measurement

Fig. 1 shows positioning of a line laser. A small tyre is virtually divided into 36 segments. We observed the part of a tyre with no lamellas. Segment No. 1 is considered to be reference one. It serves for comparison with other segments in axial direction.

The laser track designates the dependence of a number of segments vs. displacement. The width of laser tack (tyre's profile) is 60 mm. The track is automatically divided in 100 points/segments. In principle, the displacement is scanned in every determined point. It follows that a distance between them is 0.6 mm. The data are recorded every second, during 5 seconds. Usable data are obtained from average point's value of a displacement. After this operation we obtained 36 1-row matrixes corresponding to tyre's segments between lamellas.

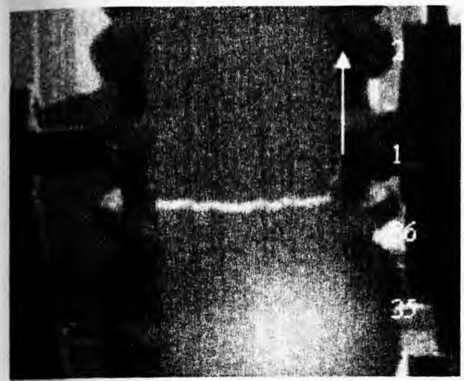

Fig. 1: Place determination of segments

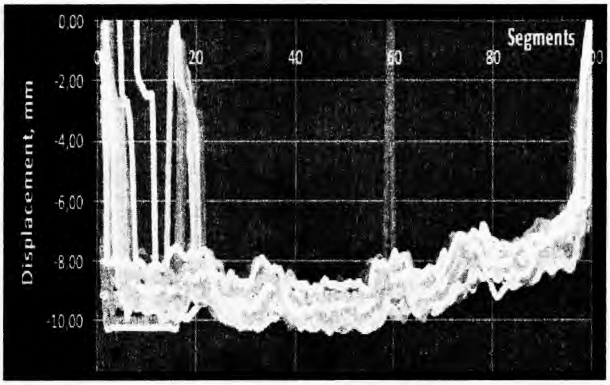

Fig. 2: Measured segments of the tyre

Fig. 3 presents the profiles of all segments which were measured. We chose the marginal records for displacement determination. The objective of the work was correct determination of x-coordinate value.

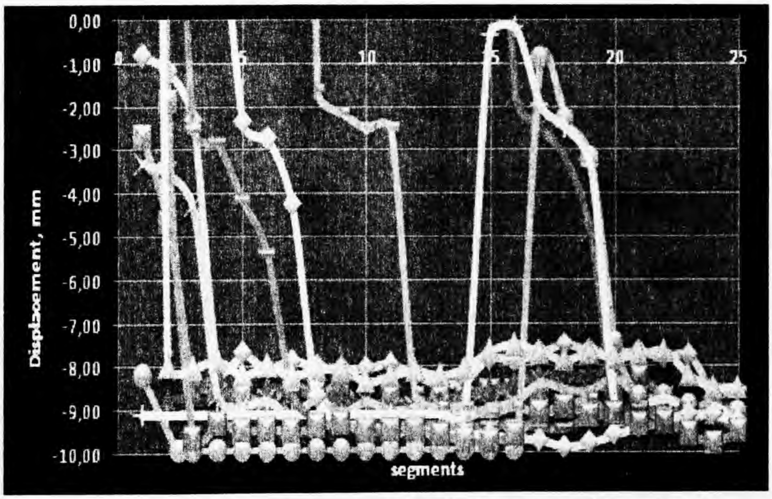

Fig. 3: The selection of segments for displacement determination

2.3 The comparison method

If we have to calculate horizontal displacement, we have to know the x-axis value for the functional value f(x) = 3.9. For this functional value it is not possible to determine the x-axis value in Excel.

The solution is proposed in Matlab® environment. Therefore the x-axis and also y-axis are divided on 10 000 elements, consequently is one segment divided on 100 elements.

We can determine real horizontal wheel displacement by counting off two x-axis values for a given f(x) and multiplying by 0.6 mm.

2.4 Data processing

The measurement provided us with 36 text files (36 wheel segments) with 5 rows (5 seconds of measurement) and 100 columns (100 segments in x-axis). For next data processing we used an average value of the rows.

Thereinafter we introduce the program for x and y-axis dividing:

```
function [x,e] = e_function(a,b)

ts = 0.01;

x0 = 1:1:100;
xi = ts:ts:100;
yi = interp1(x0,a,xi);

plot(x0,a,'o',xi,yi,'r')
xlabel('segment')
ylabel('e')

e = yi(b/ts);
x = xi(b/ts);
```

3. RESULTS

Tab. 1 shows the example of a horizontal displacement determination between the segments 1 and 17 for the functional value $y \cong -3.9$:

Tab. 1: Example of horizontal displacement determination

coordinate	seg_1	seg_17
y	-3.91	-3.893
x	3.28	19.160

H_Disp = (|19.16-3.28|) * 0.6 mm = 9.25 mm;

4. CONCLUSION

From the presented results we can conclude that it is possible to determine the horizontal displacement of a wheelbarrow with a help of a simple profilometer apparatus.

This work was done for the Etop inc. company's project. The production of these products is environment-friendly. Results were used for development of the mould.

5. REFERENCES

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