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# DEFORMATION DEPENDENCE ANALYSIS OF THE TIRE AS A SPEED FUNCTION OF TRAVEL AT THE INTERACTION OF THE WHEEL WITH THE POSITIVE BUMP

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***Abstract:*** *The automobile is a critical element for any type of society, and the vehicle's dynamic performance is a key aspect of its value. At the same time, vehicle dynamics has been studied for many years and provides a multitude of opportunities for teachers to convey vast and numerous concepts to students.*

*A key factor for the proper functioning and coordination of the vehicle is the tire, playing a crucial factor in the dynamic behavior on the roadway. The tire is a toroidal piece made of rubber, later mounted on a rim. The main function of a tire is to allow adequate contact with the roadway, maintaining a balance between grip and friction, thus enabling acceleration, braking and handling of the vehicle.* (citation, [1]).

***Keywords:*** *automobile, dynamics, tire, grip, braking*

## 1. INTRODUCTION

From a constructive point of view, there are two types of tires: radial and diagonal, the first being standard for almost all modern cars. At the same time, there are three categories according to the way of use: summer, winter or mixed tires (all season). [2]

When building a vehicle, the manufacturer imposes several sets of tires that can be mounted so that they fit the suspension system, respond precisely to steering commands, but at the same time be silent and durable. Above all, for

the vehicle to run safely, the tires must withstand the extreme forces exerted on it when braking, accelerating or cornering.

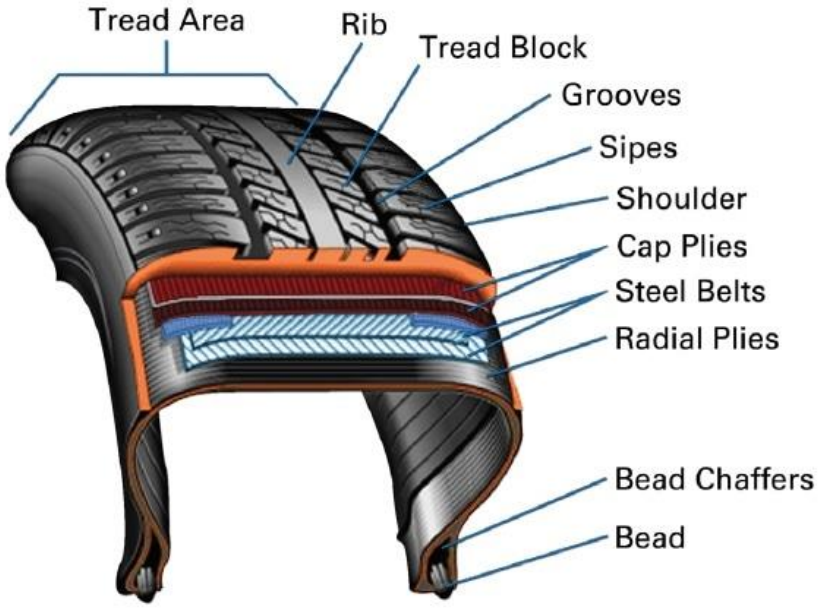



**Figure 1**. Tire structure

## 2. THEORETICAL CONCEPTS

The University of Technology in Gdansk, Poland, has created a stand that can replicate different roadway textures. It contains a drum with a diameter of 2 meters, on which various rolling media can be attached for the wheel that is embedded and turns on this drum. This stand is placed in an isobaric chamber, which allows rolling resistance tests to take place at temperatures between -15 and +30 ºC.[3]

**Figure 2**. Stand for measuring rolling resistance

## 3. TESTING SCENARIOS

The experimental tests started at the height of 50 mm and the width of 150 mm, the speeds being variable increasing by 10 in 10, starting from 10 km/h, up to 50 km/h. If damage is recorded on the tire or rim, the test is considered a success. The event took place under the supervision of teachers with qualifications and skills in this field, avoiding any kind of danger.

The series of tests will be carried out with the height of the bump constant, and the increase in speed will be done gradually and progressively after each successful test. After the 5 sets of completed and successful tests, it will be moved to the next unevenness (100 mm).

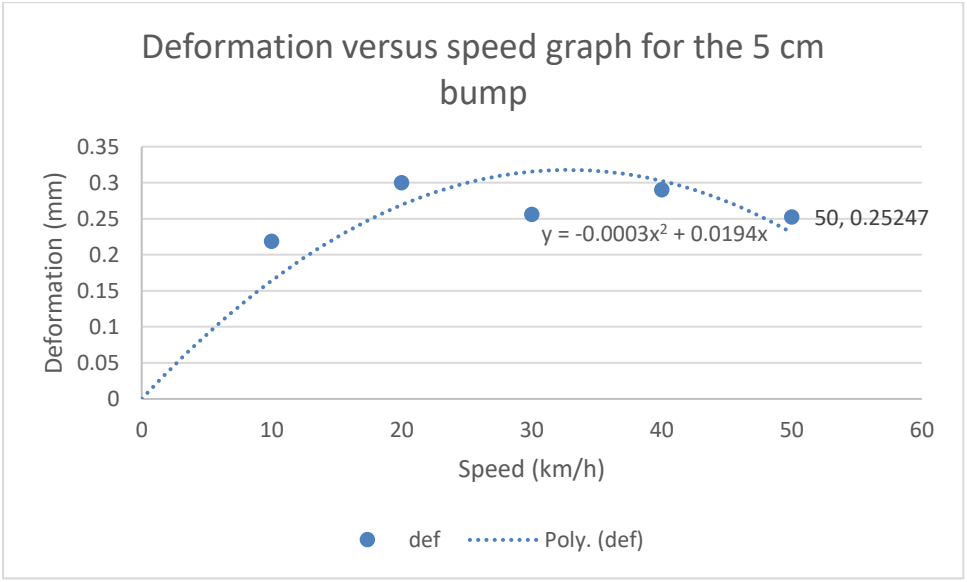
### 3.1. Comparison of experimental data

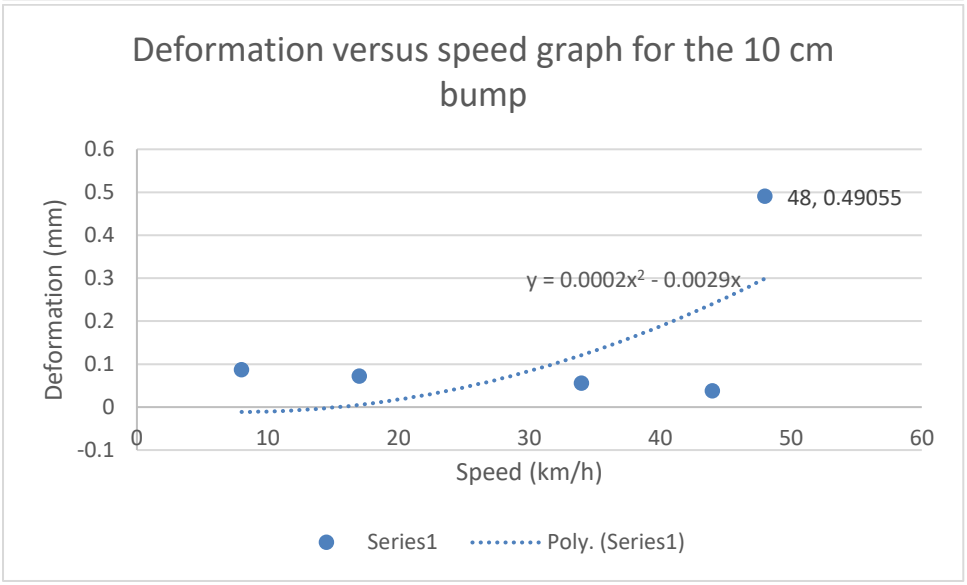
In order to determine the deformation of the tire according to the variation of the travel speed and the height of the unevenness based on the experimental tests, the values of the deformation were established for each vehicle speed. Based on these data for the variation of the speed parameters, the analytical expression of the equation expressing the dependence of the deformation according to the speed was determined by mathematical regression.

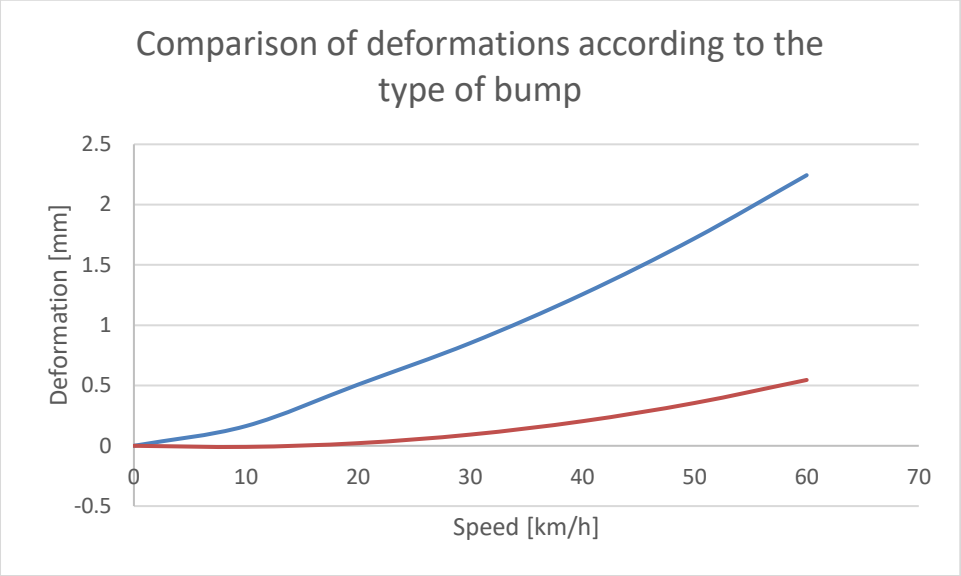
**Figure 3.** Maximum deformation of the tire in the first test

**Figure 4.** Maximum deformation of the tire in the tenth test

## 4. RESULTS






## 5. CONCLUSIONS

Due to the fact that the tire reinforcement is very advanced and the variables that enter into the composition during the design are very different, it is difficult to verify experimentally, many tests being necessary, taking into account all the costs, their simulation and virtual design being an effective help for the future of the tire industry tyres. So tire design is done using increasingly complex computers and software, thus saving money, time and human resources.

After the tests carried out, it can be found that at speeds higher than 40 km/h, following a 10 cm unevenness, the damage suffered to the wheel is directly proportional to the speed, as evidenced by the video evidence and the results obtained after processing the data on the memory the acquisition device.

Corroborating what was mentioned above, the tire deformation is strongly influenced by the speed of movement when the wheel interacts with the positive bump.

## REFERENCES

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