Doctoral Dissertation

Summary

Phd candidate: mgr inż. Rafał Łukasik
Promoter: dr hab. inż. Piotr Czech, prof. nzw. w Pol. Śl.
Assistant promoter: dr hab. inż. Tomasz Figlus, prof. nzw. w Pol. Śl.
Topic: Evaluation of the possibility of using artificial neural networks to determine the deformation of the car body

In the doctoral dissertation an attempt was made to analyse the mechanism of collision of vehicles expressed by the size of damage (work of deformation forces of the car's body) using artificial neural networks.

The collision of vehicles in road traffic is a result of the impact of many input parameters, with an ambiguous impact of their impact on the final result in the form of the deformation state of car body.

The essential features of artificial neural networks are the ability to model any non-linearity, resistance to data interference and the ability to generalize the acquired knowledge ("learning"). Thanks to these values, artificial neural networks are currently widely used in research works in many fields.

This doctoral dissertation consists of eleven chapters. After the chapters "Introduction" and "Purpose and thesis of the work", the next six chapters are a review of the literature and an essential introduction to the problem under study.

The presentation of the desirability of searching for new research methods in the reconstruction of road accidents and the awareness of the scale of the phenomena of road incidents was the chapter presenting the statistics of road accidents. In addition, this chapter gives an overview of the factors that should be taken into account when building neural models. The data presented in the chapter come from information provided by the Police and the Central Statistical Office.

The fifth chapter discusses the basic types of body structure of vehicles, construction materials and manufacturing technology in the context of the ability to absorb energy during a collision. They constitute another group of factors important in the modeling process using artificial neural networks.

In the next two chapters the basic concepts of collision theory of material bodies and motor vehicles are discussed. The amount of energy absorbed during the collision, referred to in the dissertation as the work of deformation, was defined, and the analytical and experimental methods for its estimation were discussed. These methods are used in the practical part of the work to compare the simulation results of the neural network model.

The ninth chapter proposes a set of parameters that were used in the process of neural modeling of the deformation of the body. A research form was used during the analysis of 1000 damages registered in the technical documentation of one of the insurance companies.

The tenth chapter is a discussion of neural models developed during the research. The completed research was divided into four groups of experiments.

The dissertation ends with the chapter "Summary and conclusions".