

## PhD THESIS ABSTRACT

### **”CONTRIBUTIONS TO CAR CRASH ANALYSIS AND RECONSTRUCTION IN CASE OF UNCERTAINTIES”**

*Author: eng. Irinel DINU*

*e-mail: irinel.dinu7@gmail.com, tel. 0744786711*

*PhD supervisor: bg. gen. (r.) univ. prof. eng. Ion COPAE, PhD*

The paper covers an important topic related to motor vehicles field, namely car crashes analysis and reconstruction in case of different uncertainties, increased number of vehicles and infrastructure development resulting in increased traffic and increased number and severity of car crashes. All cases analysed within the paper came from real situations, some are mode widely presented as opposed to others, depending on the intended purpose. For every case, conclusions confirmed, refuted or added facts to those already established from technical examinations made by experts.

Chapter 1 shows the topic synthesis and main goals of PhD thesis. It also contains a comparison between paper's characteristics and specialty literature approaches, illustrating the path embraced within the PhD thesis.

Chapter 2 presents mathematical grounds for collision phenomenon. It also contains main concepts, adopted hypothesis and the three general mechanical theorems used in car crash analysis and reconstruction. There are presented midpoint collisions, most used coordinate systems and off-centre collisions between vehicles, applicable to car accidents analysis and reconstruction. Also, there are introduced the most used mathematical models related to the topic, but also the most known specialized programs, with associated examples.

Chapter 3 contains a presentation of main types of parametric uncertainties occurred in practice. There are highlighted uncertainties associated with vehicle, runway and driver, in the last case by pointing out the importance of his reaction time in order to avoid a car crash.

In chapter 4 is presented the topic of analysis and reconstruction for accidents involving vehicles alone, by taking into account the parametric uncertainties. Main concepts from interval analysis are shown and accidents specific sizes are established, such as: speeds, distances, accelerations, external torques and powers, braking forces, normal forces, angles and angular speeds, kinetic and deformation energy, vehicle's body rigidity and deformations etc. Likewise, uncertainty theory is used by taking into account the subjectiveness uncertainties introduced by technical expert. For the analysis and reconstruction of real car accidents, it is used the PC-Crash program.

Chapter 5 is intended to the analysis and reconstruction of car accidents involving people. There are presented main concepts of impact biomechanics and there are assessments of different sizes in case of uncertainty, such as accelerations, speeds, distances, torques, contact forces, spring forces etc. Also, there are established values of some evaluation criteria of the car accidents effect on people.

In chapter 6 is presented the spectral analysis for car accidents. There are shown mathematical models of actual impact, which are used in specialty literature and there are established: deformations, speeds and accelerations, but also proper frequencies. Likewise, it is presented the frequency analysis and time-frequency analysis of car accidents.

Chapter 7 contains main contributions to the studied topic and there are stated some openings offered by the paper. Also, it is highlighted the dissemination of research results and it is presented the list of papers published in the meantime.