



ROMANIA
MINISTRY OF EDUCATION
UNIVERSITY OF PITESTI

HABILITATION THESIS

Summary

Virtual Reality For Automotive Design

Domain: Aerospace, Automotive and Transportation Engineering

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SUMMARY

Within this habilitation thesis are presented the author's main innovative scientific results, obtained after the PhD thesis completion at Transilvania University of Braşov, in 2007, until the presentday, in the field of using virtual reality technologies for autovehicle design.

The thesis is structured in two sections: the first one in which is presented the abstract of the thesis (A) and the second one in which are presented the main scientific, professional and academic achievements during the course of five chapters (B1), the plans regarding the evolution and development of the academic career (B2) and the bibliography (B.3).

In **chapter 1** is presented an introduction on Virtual Reality (VR) techniques with the purpose of highlighting the advantages of using these technologies in autovehicle design.

In **chapter 2** is described an innovative virtual prototyping concept using haptic feedback. In the first section of the chapter is presented a study on the usability of generic haptic devices for virtual industrial prototyping applications. Further is presented the development of a specialized haptic device used for haptic prototyping of 1 DOF mechanisms. The proposed solution is used to illustrate a virtual prototype approach for the vehicle steering system. In the last part of the chapter is presented the design of a vibrotactile haptic device that can be integrated into the driver's seat, in order to emit dynamic haptic vibrotactile feedback to facilitate the perception of warnings received from an ADAS system.

Chapter 3 illustrates a new concept of using virtual and augmented reality technologies for collaborative concurrent engineering. The advantages and the major issues of using VR / AR technologies are analyzed, such as CAVE type 3D immersive systems, collaborative augmented reality systems, tele-immersive systems, distributed virtual environments that allow the choosing of the appropriate VR / AR system according to specific requirements of the engineering applications.

Chapter 4 presents the development and usage of VR natural user interface (VR NUI) systems for CAD. The following aspects are detailed: the introduction of omnipresent natural interfacing systems, the usage of natural interfacing technologies for computer assisted design, comparative

study regarding the usage of RV technologies versus conventional WIMP technologies, CAD modeling assessment using NUI VR technologies.

The use of VR technologies for the development of ADAS systems has been studied with the author's participation as a member of the research team within the NAVIEYES project: Intelligent car navigation assistant for mobile devices based on eye gaze tracking and head pose, Contract no. 240 / 2014. **Chapter 5** presents the development and assessment of an ADAS system in VR environment using the Kinect RGB-D camera to identify the driver's degree of attention. There is also presented a study investigating the influence of using smartphone applications on the driver's degree of attention in a virtual reality simulator for real traffic situations.