

Andras Kemeny
Frédéric Mérienne
Stéphane Espié
Editors

Trends in Driving Simulation Design and Experiments

Proceedings of the Driving Simulation
Conference Europe 2010

Arts et Métiers ParisTech, Paris, France
September, 9th and 10th 2010

SÉRIES & ACTES
© Les collections de l'INRETS
August 2010

Direction

Andras Kemeny Renault, Technical Center for Simulation
andras.kemeny@renault.com

Renault, Technical Center for Simulation
1 Avenue du Golf, 78288 Guyancourt
Arts et Metiers ParisTech
2 rue Thomas Dumorey, 71100 Chalon-sur-Saône

Organisation Committee

Stéphane Espié, INRETS
Frédéric Mérienne, Arts et Metiers ParisTech
Andras Kemeny, Renault, Arts et Metiers ParisTech

Scientific Committee

Andras Kemeny, Renault, Arts et Metiers ParisTech (France)
Wade Allen, STI (United States)
Jost Bernasch, The Virtual Vehicle (Austria)
Alain Berthoz, LPPA (France)
Willem Bles, TNO (Netherlands)
Erwin R. Boer, University of California, San Diego (United States)
Heinrich H. Bühlhoff, Max Planck Institute for Biological Cybernetics (Germany)
Viola Cavallo, INRETS (France)
Stéphane Espié, INRETS (France)
Jeff Greenberg, Ford Motor Co. (United States)
Eric Groun, TNO (Netherlands)
Alexander Huesmann, BMW Group R&T (Germany)
Wilfried Käding, Daimler (Germany)
Frédéric Mérienne, Arts et Metiers ParisTech (France)
Staffan Nordmark, VTI (Sweden)
Gilles Reymond, Renault (France)
Nicholas Ward, University of Montana (USA)

Institut national de recherche sur les transports et leur sécurité – INRETS

Direction scientifique / politique éditoriale – Aude Lauby
25 avenue François Mitterrand Case 24, 69675 Bron Cedex, France
Tél. : +33 (0)4 72 14 23 20 – Fax : +33 (0)4 72 37 68 37 – www.inrets.fr

© Les collections de l'INRETS – Réf. A126

ISBN 978-2-85782-685-9

ISSN 0769-0266

En application du code de la propriété intellectuelle, l'INRETS interdit toute reproduction intégrale ou partielle du présent ouvrage par quelque procédé que ce soit, sous réserve des exceptions légales.

Preface

The DSC Europe conference, held this year at the Arts et Métiers ParisTech, is a gathering event between two communities: scientific researchers interested in drivers' behaviour and perception, and developers of technologies for the rendering of the behaviour and environment of vehicles.

These last years have witnessed the appearance of several high performance driving simulators at several car makers and universities all over the world as well as a larger and larger use of low-cost simulators for a growing number of human factors, vehicle engineering, road traffic and training applications .

Multi-sensory integration issues, including transport delay and rendering scaling, become more important with new scientific questions and are discussed by the authors. Thus, this DSC 2010 Europe Conference will bring a panorama of the most recent experiments and results that researchers and engineers have obtained in the field of driving simulation.

This year, the plenary sessions allowing the participants to attend all sessions were completed with a Poster and Product Solutions session in order to provide attendees with a technological panorama also.

The DSC Europe Organization Committee

Contents

Preface	3
Introduction (<i>Andras Kemeny</i>).....	9

Keynote address

Visual control of driving and flying: Importance of optic flow rules, perceptual representation of 3-D space, and internal models of vehicle dynamics (<i>Jack Loomis</i>)	13
--	----

Perception and human factors

Simulating the Effect of Low Lying Sun and Worn Windscreens in a Driving Simulator (<i>Jonas Jansson, Anne Bolling, Gunilla Sørensen</i>).....	23
Flexibility of the cognitive system to use various spatial coding: implication for driving situation (<i>Eve Dupierrix, Alain Berthoz</i>)	33
Drivers' perception of loss of adherence in bends (<i>Thomas Denoual, Franck Mars, Jean-François Petiot, Gilles Reymond, Andras Kemeny</i>)	43

Simulation design and architecture

Heading towards Eye Limiting Resolution – Display systems in driving simulation (<i>Alexander Huesmann, Martin Strobl</i>).....	57
Impact of geometric field of view on speed perception (<i>Florent Colombet, Frederic Merienne, Andras Kemeny, Damien Paillot</i>) ..	69
Influence of display type and field of view on drivers' performance in a motion-based driving simulator (<i>Volker Grabe, Paolo Pretto, Paolo Robuffo Giordano, Heinrich H. Bülthoff</i>)	81
Transport delay characterization of scanner driving simulator (<i>François Saidi, Guillaume Millet, Gilles Gallee</i>)	89
Software assembly and open standards for virtual reality and driving simulation (<i>Nicolas Filliard, Emmanuel Icart, Jean-Luc Martinez, Sébastien Gerin, Frédéric Merienne, Andras Kemeny</i>).....	99

Motion rendering

Performance identification and compensation of simulator motion cueing delays (<i>Zhou Fang, Gilles Reymond, Andras Kemeny</i>)	111
---	-----

Motion cueing for 3, 6 and 8 degrees of freedom motion systems (<i>Martin Fischer, Håkan Sehhammer, Göran Palmkvist</i>)	125
SHAKE – an approach for realistic simulation of rough roads in a moving base driving simulator (<i>Anne Bolling, Anders Genell, Mattias Hjort, Mats Lidström, Staffan Nordmark, Göran Palmqvist, Håkan Sehhammer, Leif Sjögren, Mikael Ögren</i>)	135
Motion Cueing Algorithm online parameter switching in a blink of an eye – a time variant approach (<i>Tobias Lorenz, Klaus Jaschke</i>)	145

Keynote address

Daimler's New Full-Scale, High-dynamic Driving Simulator – A Technical Overview (<i>Eberhard Zeeb</i>)	157
--	-----

Virtual prototyping and training

Familiarization with a forward collision warning on driving simulator: cost and benefice on driver, system interactions and acceptance (<i>Arnaud Koustanai, Arnaud Mas, Viola Cavallo, Patricia Delhomme</i>)	169
Eco-driving performance assessment with visual and haptic feedback assistance (<i>Slim Azzi, Gilles Reymond, Frederic Merienne, Andras Kemeny</i>)	181
Driver performance assessment in driving simulators (<i>Bart Kappe, Leo De Penning, Maarten Marsman</i>)	191
Driver trust and reliance on navigation systems: effect of graphical display (<i>Adrien Barthou, Andras Kemeny, Gilles Reymond, Frederic Merienne, Alain Berthoz</i>)	199

Product solution & posters session

Toward a standard: RoadXML, the road network database format (<i>Julien Chaplier, Thomas Nguyen That, Marcus Hewatt, Gilles Gallee</i>)	211
The Development of a Low Cost Driver Licensing Simulator (<i>R. Wade Allen, Woon San Joe, George D. Park, John K. Grant</i>)	221
OpenDrive 2010 and beyond-Status and future of the de facto standard for the description of road networks (<i>Marius Dupuis, Martin Strobl, Hans Grezlikowski</i>)	231
Truck simulator an instrument for research and training (<i>Gianfranco Fancello, Agostino Bruzzone, Maria Grazia Carta, Enrico Bocca, Alberto Tremori, Paolo Fadda</i>)	243
Design of a Modern Image Generation Engine for Driving Simulation (<i>Bob Kuehne, Sean Carmody</i>)	259

<u>Approach to Improvement of Realistic Sensation on Universal Driving Simulator</u> (<i>Daisuke Yamaguchi, Yoshihiro Suda, Masahiko Aki, Masaaki Onuki, Osamu Shimoyama</i>).....	267
<u>Pro-SiVIC and Roads, a software suite for sensors simulation and virtual prototyping of adas</u> (<i>Nicolas Hiblot, Dominic Gruyer, Jean-Sébastien Barreiro, Bertrand Monnier</i>).....	277