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Volvo Cars
C. Sandberg, M. Boerboom

Title
Objective vehicle assessment in a driver in-the-loop simulation using generic motion cueing

Abstract
Volvo Car Corporation wants to use the DiM simulator to bridge the gap between CAE development and subjective vehicle assessment, enabling CAE to drive technological development from concept to final product. Ensuring high confidence in results produced with the DiM is essential to replace assessments that are currently performed in physical vehicles.
This presentation will demonstrate the complex chain of activities required to set up the DiM; from vehicle model build - motion cueing tuning - to driver feedback. For this purpose, a CAE model was built from measurements of a test vehicle, thereby incorporating the actual non-linearities and asymmetries of the vehicle. This model is extensively tested and verified against measurements of full vehicle manoeuvres. Furthermore initial motion cueing settings are tuned using offline simulations. Finally a generic motion cueing setting for vehicle dynamics attribute evaluation is created using professional drivers.

Ferrari S.p.A.
M. Barbieri, M. Fainello

Title
GT race car traction control development using integrated SIL/HIL techniques in a high performance driving simulator

Abstract
Simulations and driving simulators are nowadays powerful tools for automotive development. We use it to debug and calibrate active controls on street cars, so we tested the same procedure for our GT race car traction control. The experience was very useful, since we could set many factors (i.e. grip level) and repeat sessions with exactly the same track, ambient and tyres condition changing only TC calibration. This gave us the opportunity to optimize TC behaviour in these different conditions and put the resulting calibrations all together in the final calibration loaded on the car (connecting different grip levels to the TC knob). Drivers' comments and data analysis show a very good correspondence between the resulting real TC behaviour and the simulation one. Thanks to this procedure, we not only reduced the on-track/track-by-track TC calibration adjustments but also improved the TC strategy.

University of Sao Paulo, Multicorpos
A. P. Iarocca, A. Costa Neto, M. A. Castillos, A. Figueira

Title
Use of driving simulators for the evaluation of road signs effectiveness

Abstract
The objective of the present work is to evaluate dimension and location of road signs. The project is based on statistical analyses and cognition tests performed on drivers. These tests capture driver's reaction with appropriate equipment, while operating on a driving simulator. The simulator architecture include the three main elements of a road environment: the driver, the vehicle and the road itself. The simulator also needs to have the capability of capturing various aspects of driver behaviour in order to assess road signal effectiveness. For this purpose, the SmartEye tool is adopted. To model the vehicle, the VI-CarRealTime software from VI-grade is chosen, in order to have the capability of modelling various vehicle types and models. The scenario modelling has to include a particular stretch of a Brazilian highway. The road modelling, which includes varying traffic intensities and capabilities for scenario modification, is realized with VTD and Road designer from Vires.

Magneti Marelli, University of Salerno
S. Armeni, W. Nesci, A. Peciarolo (Magneti Marelli), F. Donatantonio, I. Arsie, V. Marano, C. Pianese (University of Salerno)

Title
Path reconstruction model for EH-based applications - from VI-grade to field tests

Abstract
Nowadays the development of Advanced Driver Assistance Systems (ADAS) based on environment perception (Electronic Horizon) can play a key role in emissions reduction and vehicles performance improvement. In this framework, the implementation of an ADAS horizon provider requires accurate estimation of vehicle position and path, to identify optimal speed, gear or trajectory. For this purpose, the present work, undertaken by the CO2RE-Lab, a joint research laboratory University of Salerno - Magneti Marelli, describes a kinematic model that enables the path line reconstruction from on-board vehicle measurements, by exploiting forward velocity, lateral velocity and acceleration to account for slip effects. The Path Reconstructor has been integrated within the VI-grade technology and validated by means of simulation and experimental data. The good level of precision achieved, fast implementation and data availability directly from on-board sensors, make the tool well suitable for on-board applications.

TASS International, VI-grade
R. van der Made (TASS International), R. De Vecchi (VI-grade)

Title
Developing advanced ADAS systems with virtual simulation

Abstract
TBD

Ferrari S.p.A.
F. Mincigrucci, S. Varisco

Title
Emotional development

Abstract
Reaching an absolute performance is the key factor to be the fastest, but being there only is not enough. The driving experience of a high performance vehicle must be engineered keeping in mind feeling and emotions associated with the driver that is actually performing the ride. Therefore, the mechatronic setup of the vehicle itself must be designed by principle and furthermore developed accordingly to achieve the entire goal. Being previously linked to an extensive experimental development based on testing with pilots, the process has been now moved to extensive usage of virtual tools for the well-known advantages implied. The question then becomes: “Are the instruments and the tools available well suited to predict the performance as well as the driving emotion?”

Danisi Engineering
G. Danisi, C. Annicchiarico, T. Wright, F. Vinattieri

Title
Target setting for an “EPS in the Loop” test bench

Abstract
A test bench for steering feeling simulation has been conceptualized, combining a static driving simulator with a physical EPS assisted steering rack. The ultimate goal is to more accurately reproduce tactile feedback to the driver by including physical hardware in lieu of complicated and difficult to obtain software models. The focus of activities in this paper were to define the specifications for this test bench. The test bench contains several actuators to load the steering rack in the correct way and the specifications of these actuators have been derived from a loadcase of a high performance GT sports car due to the high combined force/speed demands that it presents. The force spectra was obtained via strain gauge measurement of the track rod of a commercial GT vehicle: a set of maneuvers encompassing different driving conditions

were performed, and the measured data was matched to the results of dynamic simulations and condensed to build a reliable specification framework. The paper presents the measuring system adopted and the review of the acquired data. Additionally, a first layout of the “EPS in the Loop” test bench will be presented.

Bridgestone Technical Centre Europe
A. Zorzutti

Title
AutoCRT: VI-CarRealTime application for tires development

Abstract
As mixed sizes for prestige cars and instrumental (objective) tests evaluation are becoming more and more relevant, Bridgestone Technical Centre Europe R&D Dept. developed one simulation and analysis tool (AutoCRT), supporting development engineer to design tire cornering force performance. This tool merges three software tools: VI-grade for vehicle dynamics simulation, WHANDS (by FIAT Research Centre) for vehicle performance evaluation, and one in-house Matlab based program for automatic reporting. Finally, even one not simulation expert engineer can easily run a handling virtual campaign, evaluating the effect of different tires. Developed tool can be used as DOE to pre-screen experimental specifications optimizing outdoor test workload, or as high-level support to design virtual target tire.

Fraunhofer ITWM
A. Gizatullin, E. Pena Viña, M. Kleer, K. Dreßler

Title
RODOS Driving Simulator – a platform for Human-In-The-Loop systems design

Abstract
Interactive driving simulators have been established as a proven tool to address the design and validation challenge of operator relevant systems, such as driving assistance, safety systems, in commercial machines and vehicles. This presentation addresses recent simulator improvements, especially the visualisation system. Furthermore, application scenario examples are shown.

MIRA Ltd.
M. Naylor, D. Thatcher, T. Pulford

Title
Dynamic enhancement of a Hybrid Electric Vehicle Using VI-CarRealTime

Abstract
MIRA Ltd has built on its previous experience of developing its Electric Dynamic Control (eDC) system to create a new demonstrator vehicle, known as eDC2. The eDC2 system uses a Jaguar XF rear wheel drive architecture, but with an electric motor installed on each of the half shafts. The additional torque from the motors is used to apply a yaw moment at the rear wheels to improve the vehicle’s handling, and to increase the vehicle’s longitudinal acceleration. VI-CarRealTime simulation models were used to define the eDC2 controller parameters by assessing the steady state and transient performance to improve the linear and non-linear handling balance, increase response linearity and reduce yaw rate damping and driver demands. The controller parameters were then validated and refined using the demonstrator vehicle on the MIRA Proving Ground.

C.R.F. S.C.p.A.
N. Poerio, I. Camuffo

Title
Virtual evaluation of vehicle dynamics benefits with frequency sensitive shock absorbers

Abstract
The last years a various offer of frequency sensitive shock absorbers has appeared into the market and found application especially on B/C segment vehicles. This type of dampers allows to improve the handling/ride performance compromise at a much lower cost with respect to the semi-active ones. Hence, the need to properly simulate this component in order to correctly predict vehicle dynamics has become more and more pressing. A functional model has been developed for MSC ADAMS/Car and VI-CarRealTime vehicle dynamics simulation environments, in order to perform handling and ride simulations. This way, the vehicle dynamics performance enhancement with respect to an equivalent conventional damper can easily be predicted.

Showa Japan
K. Inaba

Title
Steering feeling optimization using an advanced simulator

Abstract
Showa utilizes an advanced steering simulator to evaluate the performance of electric power steering (EPS) systems in early stages of the development process, conducting subjective tests and control parameters identification on different roads and tracks. For an efficient development of good steering feeling, numerical indexes and validation/verification are important. The steering feeling index is developed using a steering simulator manufactured by Showa. The presentation explains the activities required to achieve a more accurate index using the steering simulator, connected with the VI-CarRealTime and VI-GraphSim software solutions on RedHawk technology.

University of Perugia, VI-grade
F. Cianetti (University of Perugia), Francesco Ambrogi (VI-grade)

Title
Steering system tuning through virtual analysis: parameter identification and target setting of Electrical Power Steering

Abstract
The Electric Power Steering (EPS) technology is being adopted in many new vehicles because of the advantages it can offer in terms of efficiency, quiet operation, and flexibility. In such scenario the tuning of EPS systems assumes a very relevant role, and the possibility of performing it in a virtual environment can be an important advantage for the vehicle development process. The paper will discuss new formulations of single and multiple DOF models for mechanical and friction properties of the steering system, and will introduce an identification procedure from simulation and experimental results. The application of full vehicle simulation to SIL and HIL for steering system target setting will also be discussed.

Würzburg Institute for Traffic Sciences
S. Will, M. Grein, A. Kaussner

Title
Human factors research at the Würzburg Institute for Traffic Sciences (WIVW) using SILAB scenario control

Abstract
WIVW is providing research and development services focusing on the interaction between humans and technical systems. The institute is mainly working in the automotive and motorcycle sector. The main areas of research cover assistance systems and automation, controllability and usability, driver state and training related topics, clinical research as well as field operational tests and naturalistic driving/ riding studies. Arising from the need to provide a safe test environment including reproducible scenarios with a high level of control and flexible interfaces, the driving simulation software SILAB

has been developed in-house. SILAB supports driving and riding simulators in various configurations, from a single PC with a gaming steering wheel and pedals to driving simulators with multi-channel field of view, a real vehicle mock-up and a motion system.

BMW Motorcycle

S. Guth, R. Pless, S. Will, Dr. M. Geiger

Title

Concept of a dynamic motorcycle riding simulator with rider motion determination using VI-BikeRealTime

Abstract

As more and more motorcycles are being equipped with assistance and entertainment systems riders are faced with a rising number of tasks while riding. In order to investigate rider behaviour under influence of these additional tasks, a dynamic motorcycle riding simulator is constructed during the project DESMORI by BMW Motorrad, the Institute of Automotive Engineering of the Technische Universität Darmstadt and the Würzburg Institute for Traffic Sciences. This paper describes the concept and software implementation of this simulator. Based on VI Bike Real Time calculations the possibilities in motion cueing with a 6-DOF motion base are shown. Working with dynamic platform roll angles enhances the immersion, but calls for increased expenses determining the rider induced roll torque, which is used as an input to the VI BRT model. An outlook on how to realize roll torque measurement is given and the benefit of using rider induced roll torque as a simulation input is being discussed.