ABSTRACTS

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These JUMV Special Publications contain abstracts of papers and full papers presented at the 25th International Automotive Conference "Science and Motor Vehicles 2015" held on 14-15 April 2015 in Belgrade, Serbia.

JUMV – The Society of Automotive Engineers in Serbia invited kindly authors from different countries to present the most recent results of their advanced scientific and/or professional activities and thus contribute to the general topics of the Conference - Automotive Engineering for Improved Safety.

Papers submitted for publishing in both Proceedings and Book of Abstracts were reviewed and accepted by the referees from the Congress International Programme Committee.

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The duty of the Editor was to select keynote, invited and other papers. The duty of the Technical Editor was to technically align all papers with the Guidelines as close as possible. The duty of the Publisher was to edit these Publications and to prepare them for printing.

JUMV expresses the most sincere appreciation to all authors for their effort to contribute to this publication.
A STUDY ON A PASSENGER CAR CLUTCH DISC DESIGN OPTIMIZATION TO REDUCE IDLE AND GEAR RATTLE

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ABSTRACT

CO₂ reduction and achieving future emission compliance are forcing OEM’s to downsize their powertrain by displacements reduction and decreasing cylinder. On the other hand customer decision to purchase a particular vehicle influenced by an objective criteria such as low fuel consumption. Due to the fact that 3 cylinder engine becomes more popular nowadays. The 3 cylinder architecture is the simplest, the most compact and the highest fuel efficient engine; however, fuel consumption benefits are more or less marginal, when a first order mass balance system is employed to achieve acceptable NVH behavior.

The vibration levels are higher for 3 cylinder engines versus 4 cylinder engines, w/o additional balance shift(s). This difference has a very big influence on NVH behavior of powertrain and vehicles. As a result of that, a clutch system which is used for a 4 cylinder engine does not achieve NVH requirements for a 3 cylinder engine.

Aim of this study; adapting a clutch system, which used for 4 cylinder engine, to 3 cylinder engine and make a design optimization to gain the NVH performance of the 3 cylinder engine as less as 4 cylinder engine has.

KEYWORDS: NVH simulation, design optimization, rattle noise, clutch damper, idle noise
DESIGN CONSTRAINTS OF AUTOMOTIVE GEAR TRANSMISSION COMPONENTS

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ABSTRACT
Design constraint is the term which in the first step of application was substitute for the design limitation in the cases when limit is not easy to satisfy but has to be in the forced way, by compromise or by specific solution. Actual situation in the area of technical systems (TS) development and innovation implies significant increase of TS quality of action, efficiency, and behavior in exploitation. There is a lack of principally new TS’s appearance. The only possibility is left to constraint farther development of existing TS’s in desired directions. The automotive is leading area in this sense.

The article contains presentation of design constraints meaning, importance and effects. For automotive gear transmission components, design constraints are specified and discussed with the objective to review results reached by constraints application. These are functional design constraints, structural design constraints and behavior design constraints. In continue of the article systematically are presented results and solutions in automotive power transmission hybridization which are functionally constrained. The one new solution is suggested by this work. In the area of structural constraints, methodology of lightweight design and power components modularization is discussed. Behavioral design constraints of TS’s are directed to increase of reliability, reduction of vibration and noise. For this purpose specific approaches, such as “Reliability for Design” and “Vibration and noise for design” are promoted by the article.

KEYWORDS: Power transmission, Gearboxes, Engineering design, Hybridization, Lightweight design, Modularization, Reliability for design, Vibration and noise for design.
APPLICATION OF SOME ADVANCED COMPUTATIONAL TOOLS IN AUTOMOTIVE ENGINEERING

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ABSTRACT

Processes of motor vehicles development or analysis of different kinds of processes they undergo during operation often require substantial effort in order to obtain valid prediction of system behaviour. Complexity and nonlinearity of different systems and phenomena interacting with each other often require use of advanced computational tools in order to properly treat current issues when using simulations and other kinds of computer aided analysis. Aim of this paper is to present three different kinds of such approach used in different fields of automotive engineering. Described methods regard modelling of tire, magneto-rheological disc brake and thermal manikin. Preliminary results are shown and application possibilities are discussed. It was concluded that usage of advanced computational techniques is indispensable in cases when processes are governed by complex and nonlinear phenomena.

KEYWORDS: tire, neural network, virtual thermal manikin, CFD, magneto-rheological disc brake, FEM
AN APPROACH TO VIRTUAL TESTING AS A TOOL FOR IMPLEMENTATION OF THE EUROPEAN STANDARD EN1317

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ABSTRACT

The existing European standard EN1317:1998 is the framework for the guardrail design as part of the highway infrastructure. This standard states the level of containment of the guardrails considering both the vehicle and the guardrail. The crash test described in the mentioned standard is a procedure for verification of the quality and the functionality of the guardrail. If all of the parameters are within the prescribed range the guardrail can be safe for use. The aim in general of the ongoing research and this paper as well is to use the virtual testing as a tool for guardrail analysis and to minimize the virtual testing uncertainties by properly using the modeling techniques. The developed models (guardrail) and modified model (car) can be recommended for future research bringing the virtual simulation closer to the actual crash test with all the benefits arising from it.

KEYWORDS: impact severity, traffic accident, test dummy, guardrail, numerical simulation
ADVANCED VIZUALISATION TECHNOLOGIES
AS A TOOL FOR IDENTIFICATION OF
VEHICLE DETAILS AND ELEMENTS

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ABSTRACT
The advancement in technology provides engineers today with a new ability in the area of technical visualization – to create a three-dimensional (3D) manual. Compared to the existing methods for creating manuals in engineering, and the existing methods for horizontal and vertical knowledge transfer, this new methods based on 3D objects can contribute to shortening the needed time for training of engineers and also to lowering the number of errors due to human factor. With the use of augmented reality in some of the engineering processes where the use of manuals is essential, these contributions are even more convincing. This paper presents a solution, based on technical visualization, using augmented reality for identification of elements in the processes of vehicle inspection or maintenance. In addition, the paper presents an example of the use of this technology through a model of a customized application developed for the operators in order to get a visual 3D step-by-step guidance in the process of locating the appropriate data elements on the vehicle during the identification procedure. The solution provides user with ability to easily transfer knowledge, increase efficiency and improve safety of the personnel.

KEYWORDS: Augmented Reality, 3D Objects, Image Tracking, Vehicle Identification, Technical Visualization
PROJECT BOB - BICYCLE ON BUS

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ABSTRACT

Bicycle on bus (BoB) is a pilot project within CIVITAS Capital program, whose purpose is the exchange of good practices and experiences between CIVITAS cities. The project involves the development of a custom made bicycle carrier mounted on the rear side of the bus instead of purchasing a ready-made solution available on the market. The project consisted of two main parts. In the first part, potential technical solutions and the position of the bicycle carrier on the bus were analysed, and the carrier was designed. The second part included analysis of the bicycle carrier strength for different loads cases and analysis of critical welds and bolted joints. After which the bicycle prototype was built. Prototype of carrier is tested in real conditions of use. During that testing accelerations are measured in all three axes (directions) on the characteristic hilly roads. This paper describes a technical solution for a bicycle carrier, analysis of all required road safety regulations and the results of the structural analyses and data acquisition acquired during actual driving conditions.

KEYWORDS: Vehicle, Bicycle, Transport, Data Acquisition, Measurement
ENERGY-EFFICIENT DRIVING IN URBAN ENVIRONMENT
BASED ON ADAPTIVE STOP&GO CRUISE CONTROL AND
ITS IMPACT ON TRAFFIC FLOW AND EMISSION

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ABSTRACT
Energy-efficient driving followed by reduced exhaust emission and footprint, presents an attractive research field especially in the past decade. One way to obtain energy-efficient driving is to enhance the traffic flow and reduce the traffic congestion. Regarding this fact, serious steps have been taken in the Intelligent Transportation Systems (ITS) domain. All these efforts are pointed towards achieving lower driver workload, enhanced traffic flow, reduced congestion, fuel consumption and emission and improved safety. As a result, Several Advanced Driver Assistance Systems (ADAS) have been developed during this period and even introduced on the market. For an example, a Full Range Adaptive Cruise Control (ACC) is a system that integrates a conventional ACC system (for higher speeds) and Stop&Go system (for lower speeds) and leads towards enhanced traffic flow and safety.

Most of the papers in the subject field treat highway traffic. Despite those, the research presented in this paper is focused on urban traffic environment. The main characteristic of vehicles movement in urban traffic is intensive acceleration and deceleration, mainly because of no consistent traffic flow produced by the traffic lights. As a result the movement gets wavy effect, especially through urban intersections where this effect is intensified due to increased driver inattention, workload, weather and several side activities like SMS, CD and radio change, site seeing etc. In these conditions, intensive acceleration and deceleration lead towards increased fuel consumption and emission, decreased road capacity and flow, decreased driver concentration, and eventually decreased safety. This problem imposes the meaning of energy efficient driving in urban environment in a form of harmonized vehicle start and flow through intersections without unnecessary acceleration and deceleration. In order to obtain qualitative measures regarding the energy saving, the impact on the traffic flow, travel time, speed and exhaust emission, a virtual model of harmonized traffic stream is built in Matlab. The results from several simulations are compared with real traffic stream. The comparison shows that the harmonized traffic stream as a model of energy-efficient driving has significant positive influence on the fuel consumption and exhaust emission, and on urban traffic flow.

KEYWORDS: Adaptive Stop&Go Cruise Control system, virtual model, energy-efficient driving, harmonized traffic stream, real traffic stream, traffic flow, fuel consumption, emission.