Guest editorial: Scientific seminar of the Italian Association of Transport Academicians (SIDT) 2019

IET Intelligent Transport Systems

Editorial

IET Journals
The Institution of Engineering and Technology

Guest Editorial: Scientific Seminar of the Italian Association of Transport Academicians (SIDT) 2019

ISSN 1751-956X
doi: 10.1049/iet-its.2020.0477
www.ietdl.org

Modelling and simulating transport systems in the era of smart infrastructures, autonomous vehicles and big-data

An official categorisation of academic groups, which is based on the main disciplines, exists in Italy: one of these groups, within the Engineering area, is entitled 'Transport Systems', and it includes transport science and technologies, together with all the related applications, policies and analyses.

Every two years, the academicians belonging to this group meet together during a scientific seminar, in order to share their scientific and technical results; the most recent one took place at the University of Salerno (South of Italy) in September 2019; this Special Section has been developed by selecting seven of the original sixty four papers presented at the Salerno Scientific Seminar. The Special Section attracted an overall 23 papers; 7 were accepted, whilst three outside this Special Section are following an independent path, for regular issues by *IET Intelligent Transport Systems*.

The main issues dealt with in this seminar can be summarised as pertaining to innovative transport systems, services and technological solutions; special attention was paid to topics related to road safety, automation of road vehicles, pedestrian and cycling modelling frameworks.

The selected papers all contribute to obtaining a more comprehensive understanding of current and up-to-date trends of transport systems, and contribute with interesting insights both on the methodological and operational viewpoints.

Improving efficiency and safety conditions of the road network is one of the main goals of ITS. Integration and interconnection of different components of the classical system driver-vehicle-infrastructure are supported by relevant advances on technological and communications level.

The paper titled '**Coherence analysis of road safe speed and driving behaviour from floating car data**' by **Colombaroni *et al.*** presents a general analysis framework for road safety centres, aimed at safety monitoring, identification of critical points of the road network, developing of new safety enforcement schemes, and providing assistance to the driver by a safety driver advisory unit. Smart road safety analysis takes into account data from different systems, involved into road safety performance process as interaction between drivers' behaviour and safety conditions, revealed on an infrastructure level. The road geometry parameters, crucial to estimate safety conditions, are obtained by digital graphs or directly from floating car data. The critical points of the network are revealed by an aggregate analysis of crash distribution on the road, while the drivers' behaviour is addressed by floating car data on a disaggregate level, which enables the evaluation of speeds distributions with a dense spatial detail.

As still regards road safety and role of speed, **Fancello *et al.*** outline that – as a result of the enormous spread of smartphones – the issue of distraction related to their use while driving has become of primary importance due to its effects on driving performance and road safety. Their study titled '**Comparative analysis of the effects of mobile phone use on driving performance using ANOVA and ANCOVA**' investigates the extent to which driver's gender, age and driving experience can influence driver performance, when using smartphones. For this purpose, a driving simulator has been used to test the driving performance of 40 volunteers, when performing four popular smartphone tasks. Using ANOVA and ANCOVA methods it has emerged that the age factor seems to play a key role in the resulting driving performance. Older drivers tend to reduce their driving speed during smartphone tasks, while younger drivers tend to increase it. Consistently with previous research, the negative effect of smartphone use while driving is confirmed by the increased number of collisions recorded, when drivers are engaged in smartphone activities.

The previous two papers propose interesting tips for the publication by **Orsini *et al.***, who outline in their paper on '**Large-scale road safety evaluation using extreme value theory**' that emerging intelligent transport systems (ITS) and sensing technologies allow to collect large amounts of high-quality traffic data in highways, which can be used for road safety analysis. The authors outline the possibility to apply extreme value theory (EVT), which is gaining interest in the field of road safety, thanks to its ability to produce quick and reliable safety evaluations. EVT can estimate the probability of extreme events (i.e. road crashes) from relatively short observation periods, using surrogate measures of safety in place of crash data. In this work, EVT is applied for a large-scale case study in two motorways, located in North-Eastern Italy.

Road safety is, again, a central issue that assisted-driving and, possibly one day, self-driving cars are addressing, trying to assist drivers up to substituting them in the role also of supervisors. This is the evolution that ADAS are undergoing in recent years, now becoming compulsory equipment for automobiles to be registered after 2023.

Di Febbraro *et al.* in their paper on '**Traffic management system for smart road networks reserved for self-driving cars**' propose a model of a smart road network consisting of unsignalised intersections and smart roads connecting them, with the aim of presenting a traffic management system for self-driving cars (or, more generally, autonomous vehicles) which travel on the network. The proposed system repeatedly solves a set of mathematical programming problems (each of them relative to a single intersection or to a single road stretch of the network) within a decentralised control scheme, in which each local intersection controller and each local road controller communicates with the fully autonomous vehicles. The controller receives travel data from vehicles and provide them with speed profiles, once the optimal solution of the problem is determined. The proposed model is sufficiently general, and can be adapted to different scenarios of smart road networks reserved for self-driving cars.

The automation of mobility is certainly one of the main research streams of the decade, and the modelling framework traditionally adopted in the automotive development process is rapidly becoming obsolete. Indeed, the deployment and the development of connected and automated driving functions require different simulation tools and a higher level of details. Within this context, an update of classical tools is investigated in the contribution '**Integrating tools for an effective testing of connected and automated vehicles technologies**' by **Pariota *et al.*** The authors propose an Integrated Simulation Environment, based on the co-simulation of Matlab/Simulink environment with SUMO, which realistically integrate and model vehicle dynamic, control logics, driver behaviour and traffic conditions. The simulation tool has been implemented to realistic scenarios, and

has proved to reproduce connected and automated driving functions in different traffic scenarios.

Another application of ADAS, allocated in the level 3 of SAE automation levels, concerns automatic van platooning, a very up-to-date subject covered in '**Modelling and simulation of a new urban freight distribution system based on automatic van platooning and fixed split up locations**' by **Lupi *et al.*** The authors present a freight delivery system, based on automated vans. These vans can both be driven manually, for the first and last portions of the trip, as well as operate in a driverless mode, during the main part of their delivery route. The vans organise in platoons for the central part of their trip, and then split up again, as needed, to complete the last part of the delivery. A methodology to design this proposed system is presented, comprising two routing algorithms, and a simulation tool to -heuristically- determine the number of vehicles required to operate the system, as well as the schedule of the drivers.

Finally, 'smooth mobility' has also been taken into account: pedestrian flow efficiency and safety are primary requirements for the effective design and management of urban spaces, multimodal nodes and/or big attractors. Indeed, the quality and the level of comfort play a key role and should rely on effective simulation tools to identify and compare different configurations.

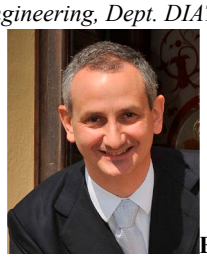
To this aim, the paper '**Simulation framework for pedestrian dynamics: modelling and calibration**' by **Liberto *et al.*** develops a multi-agent pedestrian simulation model. In particular, the authors specify and calibrate an agent-based model that microscopically simulates the interactions between individuals and with the environment. The paper presents preliminary findings from pedestrian flow experiments carried out through dedicated video recording systems, then calibrates the model parameters on observed motion behaviours. The collected data are meant to improve the calibration and validate the simulator, but they also provide insights on how the pedestrian's behaviour may have significant upshots on the theoretical framework.

Guest editor biographies

Professor Constantinos Antoniou, Technical University of Munich, Department of Civil, Geo and Environmental Engineering, Chair of Transportation Systems Engineering (Germany).

Constantinos Antoniou is a Full Professor in the Chair of Transportation Systems Engineering at the Technical University of Munich (TUM), Germany. He holds a Diploma in Civil Engineering from NTUA (1995), a MS in Transportation (1997) and a PhD in Transportation Systems (2004), both from MIT. He has authored more than 400 scientific publications, including more than 120 papers in international, peer-reviewed journals, 250 in international conference proceedings, 3 books and 20 book chapters. He is a Deputy Editor-in-Chief of IET ITS, Associate Editor of Transportation Letters, member of the Editorial Board of Transportation Research – Parts A and C, Accident Analysis and Prevention, and Journal of Intelligent Transportation Systems, and Editor of EURO Journal on Transportation and Logistics. He is also member of several scientific committees (such as TRB committees AHB45 – Traffic Flow Theory and Characteristics and ABJ70 – Artificial Intelligence and Advanced Computing Applications, Steering Committee of hEART – The European Association for Research in Transportation, and FGSV Committee 3.10 'Theoretical fundamentals of road traffic').

Professor Bruno dalla Chiara, Politecnico di Torino, Engineering, Dept. DIATI – Transport systems (Italy).



Bruno dalla Chiara is Full Professor at the Politecnico di Torino in the field of Transport Systems from 2019, having being previously Associate Professor since 2005. He holds a Master of Science in Mechanical Engineering, with specialisation in Transport systems, engineering and economics (1993), and a Ph.D. in Transport Engineering, with specialisation in ITS (1997). He has been holding the chairs, at the Politecnico di Torino, in 'Rail transport systems, urban transit and rope installations', 'Transport systems and external logistics' and part of 'Mobility'. He is the author of several publications, mainly concerning the engineering and design of transport systems, ITS, rail and intermodal transport.

Professor Stefano de Luca, University of Salerno, Engineering, Dept. DICIV – Civil Engineering (Italy).

Stefano de Luca is Full Professor of Transportation Planning and Transportation Systems Theory in the Department of Civil Engineering at the University of Salerno, in Salerno, Italy. He is the Director of the Transportation Planning and Modelling Laboratory and his research focus includes transportation planning techniques, choice modelling, signal settings design, traffic assignment models and algorithms, freight/passenger terminal simulation and optimisation. He advises city, regional, and national governments on transportation planning issues. He has authored more than 100 book chapters and journal articles, and serves on the Editorial Advisory Board for Transportation Research Part F, the Journal of Advanced Transportation and Sustainability.