Transportation Research Part C 96 (2018) 1–2

Contents lists available at ScienceDirect

Transportation Research Part C

journal homepage: www.elsevier.com/locate/trc

Editorial

Special issue on “Management of Future Motorway and Urban Traffic Systems”☆

Editorial

Traffic congestion represents a significant challenge for large and growing metropolitan areas. Recent and future advances with traffic management strategies may lead to an unprecedented improvement in traffic conditions, together with a reduction of environmental pollution and an increase in traffic safety. To this end, the development of accurate models and efficient estimation and control methodologies for traffic systems continues to present challenging issues for current and future investigations. In addition, advanced communication and automation systems are increasingly appearing within vehicles and on the road infrastructure. The communication capabilities of such systems provide for an enormous amount of floating car information allowing sensible enhancements in modelling, estimation, prediction and control approaches. Some systems may also interfere with the driving behaviour of individual vehicles, paving the way to novel traffic control paradigms in both motorway and urban environments, where connected and automated vehicles may act autonomously or cooperatively with the target of achieving desired global goals. From a traffic engineering perspective, there is need for comprehensive understanding of the behaviour of future traffic and the impact of new control tools and communication channels in relation to the appearance of novel vehicle features; while from a control perspective, efficient decentralised and distributed control strategies are required.

This special issue on “Management of Future Motorway and Urban Traffic Systems” collects high-quality papers dealing with crucial aspects of current and future traffic management, with particular emphasis on the presence of advanced vehicle communication and automation technologies. All submissions underwent a thorough peer-review process and extensive revisions, which resulted in 12 papers finally accepted for publication in this special issue.

Five papers propose novel control strategies considering the presence of connected and automated vehicles, as well as enhancing traffic control with conventional actuators. Liu et al. (2017) propose a distributed optimal control scheme that takes into account macroscopic traffic management and microscopic vehicle dynamics to achieve efficiently cooperative highway driving, testing its performance in a mixed highway traffic environment by the means of microscopic simulations. Mamouei et al. (2018) investigate the potential of automated vehicles with respect to fuel efficiency, comparing user-optimal vs system-optimal driving strategies and concluding that the latter are always preferable. Tuchner and Haddad (2017) address the formation phase of automatic platooning, by employing a control method known as interpolating control; in the experimental part of their work, the control algorithms for the platoon formation are tested in a laboratory environment using mobile robots. Stebbins et al. (2017) propose a generalised Green Light Optimal Speed Advisory system, namely a system that suggests speeds to vehicles allowing them to pass through an intersection during the green interval, by optimising delay over the entire trajectory instead of suggesting an individual speed, regardless of initial conditions manoeuvres. Finally, Csikós and Kulcsár (2017) develop a mode-dependent variable speed limit control strategy, based on a switching mode Cell Transmission Model, with the goal of maximising network throughput.

Another group of three papers is devoted to traffic state estimation in the presence of connected and automated vehicles. Wang et al. (2017) address the problem of modelling and estimating traffic streams with mixed traffic, i.e., traffic comprising both connected and conventional vehicles, comparing a nonlinear particle filtering approach based on a second order traffic flow model with a particle filter applied to a scalar conservation law. Fountoulakis et al. (2017) present a thorough microscopic simulation investigation of a recently proposed methodology for highway traffic estimation with mixed traffic, which employs only speed measurements stemming from connected vehicles and a limited number (sufficient to guarantee observability) of flow measurements from spot sensors. Finally, Rempe et al. (2017) present a novel freeway traffic speed estimation method based solely on probe data based on the three-phase traffic flow model. The accuracy of the proposed method is evaluated using real floating car data collected during two traffic congestions on a German freeway.

☆ This article belongs to the Virtual Special Issue on “Future Traffic Management”.

https://doi.org/10.1016/j.trc.2018.09.005

Available online 18 September 2018

A set of papers deals with traffic networks. Carrese et al. (2017) investigate the use of novel mobility information, which can be derived from advanced traffic surveillance systems, for dynamic demand estimation. Data heterogeneity is first analysed for the benefit of off-line demand estimation, while on-line detection of non-recurrent conditions is accounted via a sequential approach based on a local ensemble transformed Kalman filter. Tajtehranifard et al. (2018) introduce a path-based system-optimal quasi-dynamic traffic assignment framework, solved via a novel path marginal cost approximation algorithm based on a quasi-dynamic network loading procedure that incorporates a first order node model, considering capacity constrained static flows, residual vertical/point queues, and no spillback. Farid et al. (2018) develop an analytical model that allows for a person-based evaluation of alternative transit preferential treatments, which is formulated as person delay and person discharge flow at any intersection that is part of a signalized arterial, where vehicle arrivals are in platoons. Finally, Lentzakis et al. (2018) propose a new multi-class extension of a regional dynamic traffic model, where different classes correspond to different level of vehicle connectivity and automation; simulations are conducted for various combinations of classes and penetration rates.

References

Carrese, S., Cipriani, E., Mannini, L., Nigro, M., 2017. Dynamic demand estimation and prediction for traffic urban networks adopting new data sources. Transp. Res. Part C: Emerg. Technol. 81, 83–98. https://doi.org/10.1016/J.TRC.2017.05.013.

Csikós, A., Kulcsár, B., 2017. Variable speed limit design based on mode dependent Cell Transmission Model. Transp. Res. Part C: Emerg. Technol. 85, 429–450. https://doi.org/10.1016/J.TRC.2017.10.003.

Farid, Y.Z., Christofa, E., Collura, J., 2018. An analytical model to conduct a person-based evaluation of transit preferential treatments on signalized arterials. Transp. Res. Part C: Emerg. Technol. 90, 411–432. https://doi.org/10.1016/j.trc.2017.12.010.

Fountoulakis, M., Bekiaris-Liberis, N., Roncoli, C., Papamichail, I., Papageorgiou, M., 2017. Highway traffic state estimation with mixed connected and conventional vehicles: microscopic simulation-based testing. Transp. Res. Part C: Emerg. Technol. 78, 13–33. https://doi.org/10.1016/J.TRC.2017.02.015.

Lentzakis, A.F., Ware, S.I., Su, R., Wen, C., 2018. Region-based prescriptive route guidance for travelers of multiple classes. Transp. Res. Part C: Emerg. Technol. 87, 138–158. https://doi.org/10.1016/J.TRC.2018.01.006.

Liu, P., Ozguner, U., Zhang, Y., 2017. Distributed MPC for cooperative highway driving and energy-economy validation via microscopic simulations. Transp. Res. Part C: Emerg. Technol. 77, 80–95. https://doi.org/10.1016/J.TRC.2016.12.016.

Mamouei, M., Kaparias, I., Halikias, G., 2018. A framework for user- and system-oriented optimisation of fuel efficiency and traffic flow in Adaptive Cruise Control. Transp. Res. Part C: Emerg. Technol. 92, 27–41. https://doi.org/10.1016/j.trc.2018.02.002.

Rempe, F., Franeck, P., Fastenrath, U., Bogenberger, K., 2017. A phase-based smoothing method for accurate traffic speed estimation with floating car data. Transp. Res. Part C: Emerg. Technol. 85, 644–663. https://doi.org/10.1016/J.TRC.2017.10.015.

Stebbins, S., Hickman, M., Kim, J., Vu, H.L., 2017. Characterising Green Light Optimal Speed Advisory trajectories for platoon-based optimisation. Transp. Res. Part C: Emerg. Technol. 82, 43–62. https://doi.org/10.1016/J.TRC.2017.06.014.

Tajtehranifard, H., Bhaskar, A., Nassir, N., Haque, M.M., Chung, E., 2018. A path marginal cost approximation algorithm for system optimal quasi-dynamic traffic assignment. Transp. Res. Part C: Emerg. Technol. 88, 91–106. https://doi.org/10.1016/J.TRC.2018.01.002.

Tuchner, A., Haddad, J., 2017. Vehicle platoon formation using interpolating control: a laboratory experimental analysis. Transp. Res. Part C: Emerg. Technol. 84, 21–47. https://doi.org/10.1016/J.TRC.2017.06.019.

Wang, R., Li, Y., Work, D.B., 2017. Comparing traffic state estimators for mixed human and automated traffic flows. Transp. Res. Part C: Emerg. Technol. 78, 95–110. https://doi.org/10.1016/J.TRC.2017.02.011.

Claudio Roncoli
Aalto University, Finland
E-mail address: claudio.roncoli@aalto.fi

Nikolaos Bekiaris-Liberis
Technical University of Crete, Greece
E-mail address: nikos.bekiaris@dssl.tuc.gr

Rodrigo Castelan Carlson
Federal University of Santa Catarina, Brazil
E-mail address: rodrigo.carlson@ufsc.br

Guest Editors
Nikolas Geroliminis
École Polytechnique Fédérale de Lausanne, Switzerland
E-mail address: nikolas.geroliminis@epfl.ch