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THE IMPACT OF ELECTRIFIED VEHICLES ON FUTURE TRAFFIC IN CHINA AND GERMANY

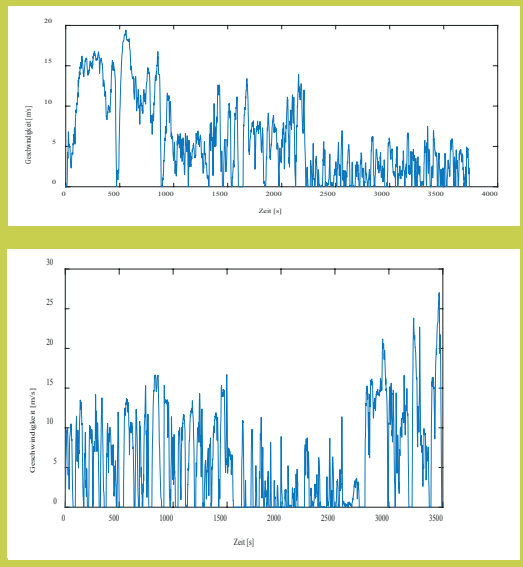
Previous Research and Motivation

Parameters defining customer needs for electrified vehicles like the energy consumption, range, environmental friendliness or costs are mainly depending on the driving behavior, vehicle characteristics and local marginal conditions like traffic and road conditions or temperature (Ried et al. 2013, Ernst et al. 2013). These data differ for each region and individual user and vary from values derived through synthetic test cycles (Hesse et al. 2012). Accordingly, for current market analysis and future trends prediction, different user profiles have to be considered and analyzed (Schüller et al. 2017).

Previous research contain a comparative empirical study on driving data and a systematic investigation of the factors of influence and local framework conditions in China and Germany. The results identify the differences between the regions. For a better representation of real driving behavior, transient driving cycles are generated (Schüller et al. 2018).

Based on simulations using these driving cycles, drivetrain concepts can be evaluated and scenarios of future vehicle trends analyzed. However, in scenario development including drivetrain concepts, the traffic as an important influencing factor for driving behavior and therefore consumption, emissions and costs is usually considered static.

Figure 1: A transient driving cycle for China (top) and Germany (bottom)



Concept

A further step to a systematic evaluation is the integration of the results in a traffic simulation model. Therefore, vehicle models are defined by parameters like the maximum velocity, acceleration, the dimensions and the powertrain. Different kinds of vehicles are parametrized for different vehicle classes and drivetrain concepts for China as well as for Germany.

Besides of the vehicle models, driver models are built and parametrized for various driver characteristics. Therefore, a method for driver modelling based on empirical driving data has to be developed.

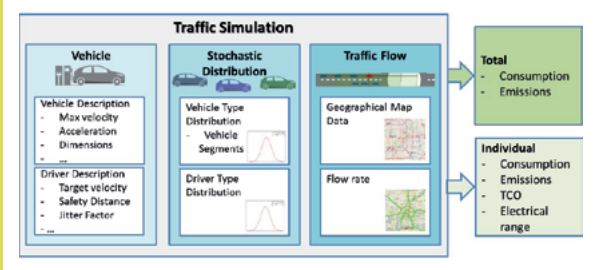
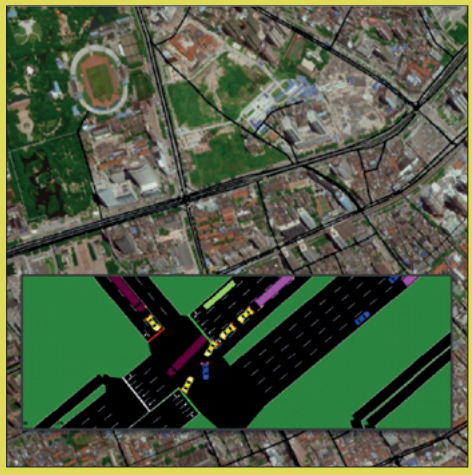


Figure 2: Traffic Simulation



Expected Results

The main target for the traffic simulation are conclusions about the impact of new mobility concepts and the share of electrified and automated vehicles on the traffic as well as total consumption and emissions in different regions like a Chinese or German city.

The results demonstrate the impact of local framework conditions with a focus on the traffic development and driver behavior and could help automakers, policy makers or city planers.

D. Schramm and M. Koppers: Das Automobil im Jahr 2025 – Vielfalt der Antriebstechnik. Berlin, Heidelberg: Springer Vieweg, 2014.

M. Ried, T. Karspeck, M. Jung, and D. Schramm: Cost-benefit Analysis of Plug-in Hybrid Electric Vehicles. In: ATZ worldwide, Vol. 115, pp. 44–49, 2013.

C.-S. Ernst, A. Hackbarth, R. Madlener (Ed.), B. Lunz, D. Sauer, and L. Eckstein: Battery Sizing for Serial Plug-In Hybird Vehicles: A Model-Based Economic Analysis for Germany. I. f. F. E. RWTH Aachen, Consumer Needs and Behavior, 2011.

B. Hesse, G. Hiesgen, M. Koppers, and D. Schramm: Einfluss verschiedener Nebenverbraucher auf Elektrofahrzeuge. In: Zukünftige Entwicklungen in der Mobilität – Betriebswirtschaftliche und technische Aspekte, ed. by H. Proff, J. Schönharting, D. Schramm, and J. Ziegler. Springer Gabler Verlag, 2012, pp. 91–104.

M. Schüller, S. Tewiele, T. Bruckmann, and D. Schramm: Evaluation of Alternative Drive Systems based on Driving Patterns comparing Germany, China and Malaysia. In: International Journal of Automotive and Mechanical Engineering, Vol. 14, Issue 1, pp. 3985–3997, 2017.

M. Schüller, W. Hou, and D. Schramm: Vergleich realer Fahrzyklen für Elektrofahrzeuge in Deutschland und China. In: H. Proff, T. Fojcik (eds): Mobilität und digitale Transformation. Springer Gabler, Wiesbaden, 2018.

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