Emerging Simulation Tools and Technologies for Testing and Evaluating Connected and Automated Vehicles

From the transportation system modeling and analysis perspective, most existing simulation tools and technologies are not well suited for connected and automated vehicle (CAV) applications due to their inability to address V2X communications as well as autonomy. Calibration of the behavioral models used in traffic simulation, e.g., CAV behavior and human driving behavior in response to CAVs, with field data needs to be addressed to ensure the validity of the modeling. From the perspective of testing automated vehicles, i.e., automated driving system (ADS) and cooperative driving automation (CDA), the necessity of using high-resolution autonomous driving simulators is broadly understood, though hundreds of millions of miles would have to be tested. In contrast to traditional simulation approaches, ADS simulations must consider the environment to a much greater degree. The simulation of ADS sensors, including LiDAR, radar, cameras, and others, will be limited in fidelity by the level of realism offered in the virtual environment.

This special issue aims to discuss emerging simulation methodologies and tools that can be applied by industry, government, and academia, to study ADS performance and impact on overall traffic systems. This issue also aims to identify respective challenges as well as research needs, and to encourage cross-disciplinary collaborations. Topics to be discussed in this special issue include (but are not limited to) the following:

- Autonomous driving simulation with perception/planning/control development and validation
- Multi-resolution traffic simulation for evaluating CAV impacts in transportation systems
- Hardware/vehicle-in-the-loop simulation
- Human-in-the-loop simulation
- Integrated cross-platform simulation
- Augmented Reality (AR) and Virtual Reality (VR) on intelligent vehicles
- Human-machine interaction simulation in a mixed traffic environment
- Data collection and model calibration for CAV simulation

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Deadline to submit manuscript:	Tentative publication date:
March 31, 2021	November 30, 2021

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