Integration of DYNA4 Car Professional with SUMO to perform virtual testing of automated vehicles in complex surrounding traffic

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Motivation

- Trends towards autonomous driving, resulting in stronger interaction of individual vehicles with surrounding traffic and traffic infrastructure
- Simulation as integral part of test strategies
- Detailed full vehicle simulation required
- Modelling of complex traffic scenarios required

Real-time capable co-simulation of DYNA4 Car Professional and SUMO to combine the strengths of both tools for virtual development and testing of ADAS and autonomous vehicles

Technology & Tools

**TESIS DYNAware**

**DYNA4 Car Professional**
- Detailed models of full vehicle incl. driving dynamics, ADAS sensors, 3D-Roads and maneuver control
- Open vehicle model structure in Matlab/Simulink
- OpenDRIVE format for road network definition
- Powerful 3D visualization with DYNAanimation for presentation, image generation and sensor simulation for driver assistance systems

**SUMO**
- Microscopic traffic flow simulation
- Traffic control and traffic management
- Conversion of OpenDRIVE to SUMO network
- Interaction with C++ TraCI API
- Level-2 C++ S-Function for integration of SUMO in Simulink environment

Methodology

S-Function

- get input signals
- sumo step? 
  - yes: save surrounding vehicle information [positions, speeds, angles]
  - no: overwrite egoVehicle [position, angle, speed]
- perform sumo step
- get egoVehicle information [position, speed, acceleration, angles, rotational velocities]
- perform dyNA4 step
- set surrounding vehicles and traffic signals

Example

SUMO

Vehicle under Test

DYNA4 Car Professional

Conclusion

Develop control units for driver assistance systems and autonomous driving with:
- complex traffic situations
- realistic traffic control
- reduced effort for scenario planning
- stochastic occurrences of traffic events

Develop intelligent transportation systems with:
- dynamic vehicle simulation
- in-the-loop simulation with vehicle control software
- high quality 3D visualization

Outlook

- Transfer traffic control measures from OpenDRIVE to SUMO
- Traffic signals: matching of SUMO internal lanes to OpenDRIVE signal heads
- Automated conversion from signs to priorities
- More complex traffic with pedestrians and bicycles
- Multiple vehicles under test for investigation of Car-to-Car functions

SUMO Conference
"Towards Simulation for Autonomous Mobility"
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