



AVxcelerate Sensors

High-fidelity physics-based camera, radar and lidar sensor simulation with ground truth information, Ansys AVxcelerate Sensors is part of the Ansys Autonomous Vehicle Simulation product family.

/ Camera sensor

Ansys AVxcelerate Sensors includes a high-fidelity, real-time, physics-based simulation of cameras. The software contains a parametric model of camera, which enables you to simulate every actual camera model. This model simulates all components such as the lens system, imager and pre-processor. For automotive front-facing cameras, the windshield can also be considered in simulation.

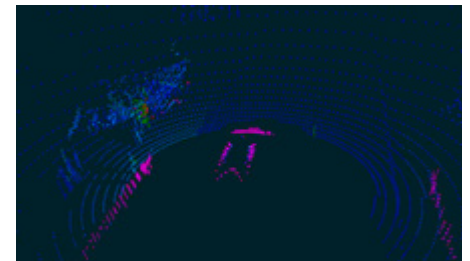


The simulation considers the optical properties of the environment in visible range, along with the optical properties of the lens system (distortion, chromatic aberration, etc.) and the optoelectronic properties of the imager (color filter array, dark current noise, etc.). With the addition of plugins, the simulation can manage dynamic adaptation (autoexposure, white balance, thermal incidence, etc...). Accurate day time simulation provides optically validated luminance and colorimetry for direct sky visualization, improving the accuracy of perception-in-the-loop simulation and testing possibilities.

The camera simulation creates raw images, which are used to test and validate perception algorithms either as models (model-in-the-loop) or software (software-in-the-loop).

/ Lidar sensor

Ansys AVxcelerate Sensors integrates the simulation of physics-based lidar model. The lidar model is designed to accurately reproduce the behavior of the laser emitter, including pulse shape angular distribution, power, beam divergence and the behavior of the optic and electronic of the receiver. All types of lidar technology (rotating, solid-state, flashing, etc.) can be parameterized in the software.



You will benefit from powerful ray-tracing GPU accelerated capabilities to simulate Lidar sensor, raw output made available through a dedicated API. Provided waveform type of output allow to challenge Lidar signal processing software. Whereas point cloud outputs combined with ground-truth segmentation provides a unique way to generate virtual sensor information during real-time drives and use the information to develop perception algorithm as part autopilot software stack.

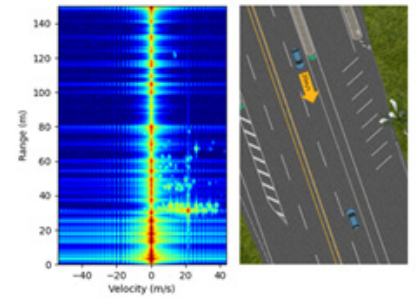
/ Radar Sensor

Radar is prevalent in driver assistance systems thanks to its high precision and exceptional scalability. Ansys AVxcelerate Sensor provides a radar model based on ray tracing simulation technique from Ansys HFSS SBR+ high-frequency electromagnetic simulator modeling interaction in electrically large environments.

The parametric model considered radar layout (Rx and Tx positioning, number of channels, interleave mode, etc...) to fit to specific automotive radars device including Multiple Input Multiple Output (MIMO) and multi-mode (SRR, MRR, LRR) waveform capability applied to current (24,77 GHz) technology or future (138 GHz). The raw data collected out of the radar model - either preprocessed range doppler map or I/Q data - is used to efficiently stimulate the digital

signal processing (DSP) algorithm part of radar ECU. It allows to quickly improve the accuracy and robustness of automotive radars in edge cases.

The high-fidelity physics-based radar simulation benefit from GPU accelerate ray-tracing engine to run in real-time while considering the dielectric properties and electromagnetic interaction. It leads to being able to simulate complex phenomena's such as micro-doppler effects on vehicle wheels!



/ Scenario and environment creation

Sensors simulation works in context. Predefined environment such as highways, country side, cities and actors such as vehicles of various type and brand, pedestrians, road signs of various countries are provided with all physics-based properties defined to be ready to use. A data preparation tools is provided when custom component is required within the scenario or what if a different material is used scenario. To test sensor system in situation, advanced scenarios and vehicle dynamics can be addressed in co-simulation with simulators. Avxcelerate sensors connects to the driving simulation software of your choice..

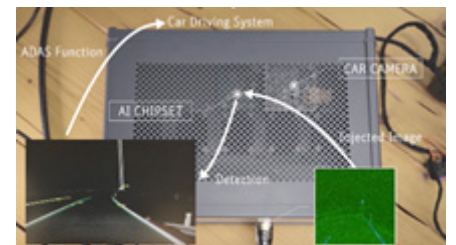


/ Software in the loop (SiL) connectivity

Simulation is designed to help validating software processing automotive sensors output, Ansys AVxcelerate Sensors is provided with a set of API allowing to connect custom signal processing on top of raw sensor outputs. Based on standard such as protobuf and grpc, outputs can be access locally or remotely on various development language such as C/C++, Python, Matlab/Simulink or Ansys SCADE.

/ Hardware-in-the-loop (HiL) connectivity

Ansys AVxcelerate Sensors uses raw sensor output to feed actual smart sensors being tested on a hardware-in- the-loop (HiL) test bench. It connects to the image injection box, which replaces the actual imager (inter-integrated circuit, or I2C) with the virtual image. The injection box also manages high-speed connections between the imager and the car-to-infrastructure (C2I) processing chip.



| Ansys AVxcelerate Sensors Features | PRO | PREMIUM |
|------------------------------------|-----|---------|
| Camera Sensor | ● | ● |
| Lidar Sensor | ● | ● |
| Radar Sensor | ● | ● |
| Environment Creation | ● | ● |
| SiL Connectivity | ● | ● |
| HiL Connectivity | | ● |
| Multi Sensors Simulation | | ● |

/ Ansys AVxcelerate Vehicle Simulation product line

- VRXPERIENCE Driving Simulator powered by SCANeR™
- AVxcelerate Sensors
- AVxcelerate Headlamp

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