IMST RCS - RADIO AND RADAR CHANNEL SIMULATOR

SIMULATION OF RADIO WAVE PROPAGATION

OVERVIEW

Knowledge of wave propagation is mandatory for design, implementation, and rollout of modern radar and radio systems. It is needed for analysis and prediction of coverage, link quality, impact of interference and mobility issues as well as for the optimisation of such parameters in the design phase of radio equipment.

IMST RCS is a numerical simulator for electromagnetic wave propagation for communication and radar applications. Given the transmitted signals at the input of the transmitting antennas, the output signals of the receiving antennas, or their statistical properties, and field strengths, are derived by the simulation. These results are important inputs for the design and optimisation of various system parameters and components (e.g. link budget, equalisation requirements, MIMO algorithms, radar signal design, etc).

IMST RCS provides a versatile and easily extensible framework for such models to address radio channel and radar tasks. It determines the channel matrix and electric field distributions using a variety of solvers, and derived quantities of interest. IMST RCS exploits parallelisation at host and GPU level.

FEATURES:

- Calculation of channel impulse response, electrical field strength, received power
- Computation of scattering parameters for all antenna pairs (channel matrix)
- Inclusion of antenna properties (complex 3D antenna radiation patterns)
- Broad frequency range
- Consideration of multipath propagation, transmission, wall attenuation, reflexion and diffraction
- Table/Database driven input for simulation specification, solvers to use, material parameters, etc.
- Easy input of environment geometry using triangular meshes, e.g. in .stl or .obj format
- Stand-alone engine for batch simulations
- Server mode for networked interaction with other tools (e.g. input of vehicle position and orientation via UDP, output of corresponding result data via UDP)

APPLICATION:

- Radar system performance analysis
- Vehicle-to-Vehicle/Vehicle-to-Infrastructure communication
- Industrial applications
- Home appliances
- Public authorities
- Unmanned aerial vehicles

USAGE:

- Radar signal/data processing algorithm design
- Determination of radar cross sections
- Optimisation of transmitter positions
- Assessment of channel capacity
- Coverage optimisation and failure detection
- Interference analysis

APPROACH

In the vast majority of applications, the channel formed by the set of transmitting and receiving antennas may be considered a linear system, so the essential knowledge pertains to channel transfer characteristics, e.g. the channel matrix formed by scattering parameters for all antenna feed line pairs. While corresponding analytical models exist, they are limited to the most simple propagation conditions (e.g. free space, two-ray, etc.). In most cases, powerful numerical models with various traits (deterministic, statistical, hybrid, geometry based, empirical, asymptotic etc.) have to be used, incorporating complex environments and precise (measured or simulated) antenna radiation patterns. For wave propagation modelling we use several such models, providing options for a trade-off between accuracy and computational effort.

- Free space/Two-ray model
- Vertical plane ray tracing
- 2D (horizontal) or full 3D shooting and bouncing
- Physical optics (PO), PTD/UTD
- Further specific models implemented according to customers' user requirements

All models may be run on a GPU to take advantage of massive parallelisation, most models may also be confined to running on CPU if no suited GPU is available.

These methods consider not only the – possibly obstructed – line of sight between transmitter and receiver, but also radio waves that travel along indirect paths that exhibit for instance several reflections. As indirect multipath components may contribute significantly to the total received signal, considering these components is essential for a comprehensive analysis especially in rich scattering and reflection environments.

The simulation includes antenna properties by using 3D complex antenna radiation patterns. Existing antenna models can be used; alternatively IMST GmbH offers antenna characterisation using measurements or simulations.

Frequency coverage
Frequency range: > 500 MHz
covering e.g. WLAN, Bluetooth, ISM, LoRa®, GSM, UMTS, LTE, WiMax, DVB-T, DAB

IMST GmbH
Carl-Friedrich-Gauss-Str. 2-4
47475 Kamp-Lintfort
Germany

T +49-2842-981-0
F +49-2842-981-199
E rcs@imst.com
I www.imst.com/rcs

02/2019