Application Datasheet
Visual System Simulator for Radar Systems

NI AWR Design Environment’s Visual System Simulator (VSS) for radar systems design enables detailed behavioral modeling of the RF and signal processing of a radar system, together with 3D antenna patterns derived from synthesis or measurement. Links to MATLAB and LabVIEW provide for custom signal processing algorithms. Links to instruments like NI PXI vector signal generators and vector network analyzers allow a device under test (DUT) to be incorporated into the simulation, where real-world signals can be captured or an impaired signal synthesized from a point in the simulated system.

Features at a Glance

- Element tree node
  - Signal processing and antenna models
- Signal processing blocks
  - Moving target indicator (MTI)
  - Moving target detection (MTD)
  - Constant false alarm rate (CFAR)
- Antenna model
  - Accept gain pattern
  - Phased array element
- Channel model
  - Doppler
  - Clutter
- Target model
  - Radar cross section (RCS)
- Radar signal generators

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The VSS Radar Design Flow Features and Advantage

Comprehensive: Advanced radar systems are very complex and depend heavily on signal processing algorithms to mitigate the effects of noise and interference. Algorithm creation requires a platform for simulation and verification and models are needed for signal generation, transmission, antenna, T/R switching, clutter, noise, jamming, receiving, signal processing, and measurements. As such, VSS for radar system design supports algorithm modeling and debugging environment languages such as C++, LabVIEW, MATLAB, and VBA.

Analysis: Modeling of the RF chains of a radar system is supported through the RF Architect (RFA) capability within VSS, which uses a frequency-domain engine to provide budget or line-up analysis similar to EXCEL, as well as spurious analysis based on mixer spur tables.

Detection: Target detection cannot be done effectively and realistically in the time-domain because small moving targets are hidden by heavily cluttered environments. Instead, detection of the signal occurs in the frequency-domain using Doppler frequency analysis.

Antennas: Antenna and phased array models are available, as is ASCII file import of antenna patterns containing data versus theta and phi. This data may be obtained from electromagnetic (EM) simulation using the NI AWR Design Environment AXIEM planar 3D EM simulator or Analyst 3D finite element method (FEM) EM simulator, third-party EM tools, or from range measurements. The receive antenna can then accept multiple inputs representing wanted signal, clutter, and jammers (all at arbitrary theta and phi).

LabVIEW Compatibility: A broad range of signal processing and software-defined, virtual instrumentation are readily accessible. In this way, simulated measurements within the LabVIEW environment can also be accessed for further domain-specific analysis or for extracting DUT measurements.

The VSS link to LabVIEW showing a custom waveform chart invoked by the LabVIEW VI.

Digital RF memory for radar jamming.

LabVIEW controls and indicators get mapped to input and output ports of a “LabVIEW Node” on the VSS diagram.