Validating fusion of GNSS/INS systems with Spirent

The SimINERTIAL Series
Fusion of inertial navigation systems with GNSS is used in applications that range from military aircraft, to autonomous vehicles, to smart phones.

Anti-jam robustness
In an ultra-tight coupled GNSS/INS system, the INS provides assistance to GNSS signal tracking loops, improving resilience to jamming attacks and their consequences.

Positioning continuity
While an INS cannot provide absolute position, a tightly coupled GNSS/INS system can provide extended navigation capabilities in GNSS-denied areas compared to a loosely coupled solution.

Enhanced precision
A loosely coupled GNSS/INS system can provide better precision in GNSS degraded environments than a standalone GNSS system. As always, the grade of the inertial system used will determine the expected precision.

Spirent has been the trusted partner for the integration of advanced GNSS/inertial systems for decades, helping a broad range of customers deliver robust, high-precision PVT solutions. As the requirement for greater positioning and navigation capability has evolved, Spirent has developed solutions to suit the requirements of differing applications — helping our customers to identify cost/performance trade-offs, minimize costly field testing and verify performance at every development stage.

Spirent’s inertial simulation series supports:
Accelerometer | Gyroscope | Magnetometer | Compass | Barometer

GPS + Inertial Testing Example

Plug & Play — Supported EGIs

<table>
<thead>
<tr>
<th>Variant</th>
<th>Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>Honeywell H-764G, SIGI and NAV100™ IMU</td>
<td>Via Honeywell’s proprietary ISRS2 card</td>
</tr>
<tr>
<td>Northrop Grumman LN100G, LN250, LN251 and LN260</td>
<td>Via the supplied RS422 card</td>
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</table>

Plug & Play — Supported IMUs

<table>
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<th>Variant</th>
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<tbody>
<tr>
<td>Honeywell HG-1700, HG-1900 and HG-9900</td>
<td>Via the supplied RS422 card</td>
</tr>
<tr>
<td>Northrop Grumman LN200</td>
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<tr>
<td>NATO STANAG 4572</td>
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<tr>
<td>AIS SiIMUO2 and SiNAV02</td>
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Lists of supported EGIs and IMUs are not definitive — new systems are added regularly.
Testing the leading EGIs and IMUs

Our inertial simulation tools enable users of embedded GPS/inertial systems (EGIs), individually coupled GNSS/INS systems (IGIs) or standalone IMUs to simulate coherent GNSS and sensor measurements to evaluate the positioning algorithms. Modeling physical sensors using accurate error parameters in our simulation environment enables users to tune integrations and algorithms prior to deployment.

Coupled with Spirent’s industry leading GNSS simulation platforms, and powered by SimGEN, our inertial simulation tools provide real-time emulation of raw measurements that can be fed into filters within the positioning engine. With the flexibility to support a variety of data interfaces and formats, our inertial simulation tools have supported the development of integrated GNSS/inertial systems for over 30 years, including on prestigious projects such as NASA’s Orion.

Testing MEMS sensor integration into a positioning engine

Built on the proven SimINERTIAL architecture, the SimSENSOR variation of Spirent’s inertial simulation tools delivers modelled MEMS sensor data to the sensor fusion engine. Building on the GSS7000 and GSS9000 GNSS simulators, SimSENSOR replaces the MEMS chip output with delivery of data as a UDP stream over Ethernet. Alternative delivery mechanisms include SPI an dI2C.

- Outputs consistent with any simulated trajectory
- Fully coherent with GNSS simulated signals
- Users can:
  - add deterministic and stochastic errors
  - load error models via DLL

Testing multi-sensor In-Vehicle Navigation Systems (IVNS)

SimAUTO provides a turnkey solution to testing integrated navigation systems comprising GNSS and dead reckoning (DR) sensors. Coherent GNSS and DR sensor emulation facilitates rapid and comprehensive system testing, accelerating time to market whilst improving demonstrated system resilience to real-life challenges such as multipath interference and signal obscurcation.

SimAUTO enables:

- Simultaneous emulation of multiple oned reckoning sensors coherent with GNSS
- Heading and wheel count sensor outputs
- Capability to drive a single-axis rate table
- Data streaming output for sharing modelled vehicle motion
- Operation with Vector CANoe

ISO/IEC 17025:2005
The GSS9000 is calibrated to the ISO 17025 standard at the time of delivery.