A Review of Activities in VXI, LXI and PXI Test Systems

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Automated test systems using standardized modular equipment have become widely used, especially in military and aerospace applications where consistent procedures and long operational lifetime are essential. The main system standards are VXI, LXI and PXI. (See the following page for descriptions of these systems.) VXI is based on the long-established VMEbus, while PXI is based on the PCI bus used in the personal computer industry. Both have the advantage of using well-established form factors. LXI extends VXI into LAN communications, also using a well-established communications protocol, Ethernet.

The following announcements of new products for these systems reveal some of the important performance issues and operational features that test engineers must consider when developing test systems.

GPS Simulation Toolkit 1.5 for LabVIEW

National Instruments has announced the NI GPS Simulation Toolkit 1.5 for LabVIEW, an extension of the graphical system design environment that expands the NI RF PXI platform to provide engineers a cost-efficient, high-performance solution for GPS receiver testing that exceeds the capabilities of traditional box instruments. The latest version of the GPS Simulation Toolkit gives engineers new satellite simulation features including extended time duration of non-repeating GPS satellite signals and the ability to customize motion profiles for mobile receiver tests.

The GPS Simulation Toolkit offers engineers an easy-to-use graphical API for validating and testing GPS receivers. Using the toolkit, engineers can simulate C/A codes for up to 12 satellites in the L1 band. The toolkit also features waveform creation tools to specify both the receiver location and velocity, and the ability to create waveforms with up to 24 hours of non-repeating GPS satellite signals, giving engineers a longer period of non-repeating simulation data than other GPS test solutions. This makes it possible for engineers to achieve extended reliability testing and superior control over signal impairments introduced during design verification testing.

The latest version of the toolkit also adds new capabilities for generating custom motion trajectories, so engineers can simulate the signals that GPS receivers capture on specific routes. The ability to simulate these signals using software-defined instrumentation helps engineers conduct customized and repeatable tests featuring route-specific signals without performing expensive drive tests. Additionally, with the GPS Simulation Toolkit, engineers can adjust individual satellite signal powers during signal generation for dynamic range and scenario-specific tests.

The NI RF PXI platform for GPS simulation and test includes the GPS Simulation Toolkit 1.5 for LabVIEW, NI PXIe-5672/73 vector signal generator, NI 8260 in-chassis RAID hard drive, NI PXIe-8106 dual-core controller and NI PXIe-1062Q eight-slot chassis. Engineers can store up to 45 hours of simulated GPS signals on the 1 TB NI 8260 in-chassis RAID hard drive and stream the GPS waveforms from disk using the NI PXIe-5672/73 vector signal generators for customized and repeatable GPS receiver testing.

National Instruments
www.ni.com

High-Power PXI Signal Generators

Aeroflex announces an expansion of its flexible PXI modular test platform with the addition of two new 3020 Series high-power and compact RF signal generators. The 3020 Series are compact, high-precision PXI modular RF signal generators with integrated dual-channel arbitrary waveform generators suitable for R&D, manufacturing and design verification of RF components and systems. The addition of the 3021C and 3026C extend the output power range of the 3020 Series to +17 dBm for frequencies up to 3 GHz and 6 GHz, respectively.

The 3021C and the 3026C weigh in at 1 kg. (2.2 lbs.) and occupy just 3 × 3U PXI slots. In addition, both of these new signal generators achieve low DC power consumption of less than 50 watts, which results in lower running costs than conventional instruments.

The 3026C, the new flagship signal generator of the Aeroflex PXI line, has a frequency range of 1 MHz to 6 GHz with +17 dBm of output power, providing direct input stimulus to power amplifiers without the need for

VXI, LXI and PXI Defined

VXI (VME Extensions for Instrumentation)

VXI began in the mid-1980s, and the VXI Consortium was founded in 1987 by a group of interested companies, including HP (now Agilent), Tektronix, Racal Instruments (now EADS North America Defense Test & Services), Colorado Data Systems, and Wavetek (now Fluke). The Consortium was created to fill the need for an open industry standard. Its objectives were stated as:

- Capability of handling demanding electronic test problems
- Open standard to all designers/manufacturers
- Interoperability with modules that would work together seamlessly
- Ability to reduce the size of current instrumentation
- Ability to increase the speed of Automatic Test Equipment (ATE) systems
- Be a cost-effective ATE solution

In short, VXI is an enhancement to the older VMEbus, which had become a standard for modular computing, control and instrumentation systems. VMEbus required updating, including the backplane design, interface connections, and card/module form factor. VXI filled these requirements, with an emphasis on high performance automated test, primarily for military and aerospace applications.

One of the principles behind VXI was that the test systems have long operational life, yet be flexible enough for implementation of new systems with ever-increasing performance. With a large installed base currently in operation, that objective has been met.

LXI (LAN eXtensions for Instrumentation)

While the basic VXI modular structure has survived for nearly 23 years, the growth of interconnected systems has required new capabilities. Communications with remote sites, centralized data collection and analysis, and other types of data sharing highlighted the need to improve the communications interface of VXI.

In 2004, Agilent Technologies (formerly Hewlett-Packard) and VXI Technology, Inc., introduced LXI, combining the best of GPIB instruments and VXI modules. The objective was to combine the reduced size of VXI, high throughput of LAN communications, and the high performance measurements of GPIB-controlled instruments. Signals enter and exit the LXI modules from the front panel while LAN (IEEE 802.3), power, and trigger cables are found on the back of the module. This differs from a VXI card cage system, but remains compatible with VXI through the use of conversion equipment that makes an appropriate bridge between LXI and VXI hardware.

Through its use of the common Ethernet communications interface, LXI can be used at any level of network complexity, from a local test system with LAN connection as simple as one instrument and a controlling computer, to large remotely operated and/or monitored test systems.

An example of LXI's advantages is the collection of data from a large number of sensors, such as deflection sensors in an aircraft or temperature sensors in a large composite materials process oven. Those sensor networks can communicate with standard hardware and software, simplifying implementation with no cost in performance.

PXI (PCI eXtensions for Instrumentation)

National Instruments developed and announced the PXI specification in 1997 and launched it in 1998 as an open industry specification to meet the increasing demand of complex instrumentation systems. Currently, PXI is governed by the PXI Systems Alliance (PXISA), a group of more than 50 companies chartered to promote the standard, ensure interoperability, and maintain the PXI specification. Because PXI is an open specification, any vendor is able to build PXI products. These notes are adapted from information available from National Instruments.

PXI is a rugged PC-based platform that offers a high-performance, low-cost deployment solution for measurement and automation systems. PXI combines the Peripheral Component Interconnect (PCI) electrical bus with the modular Eurocard mechanical packaging of CompactPCI and adds specialized synchronization buses and key software features. PXI also adds mechanical, electrical, and software features that define complete systems for test and measurement, data acquisition, and manufacturing applications. These systems serve applications such as manufacturing test, military and aerospace, machine monitoring, automotive, and industrial test. Interoperability between CompactPCI and PXI is a key feature of the PXI specification.

As the commercial PC industry improved the available bus bandwidth by evolving from PCI to PCI Express in late 2005, PXI has also incorporated higher bus bandwidth capabilities with the introduction of PXI Express, integrating PCI Express into the PXI standard.

The development and operation of Windows-based PXI systems is no different from that of a standard Windows-based PC. Additionally, because the PXI backplane uses the industry-standard PCI bus, writing software to communicate with PXI modules is, in most cases, identical to that of PCI boards.

PXI instruments are available as PCI cards, or as modules for a standard chassis. A typical PXI chassis includes a controller PC using the appropriate chassis form factor and interface. More than 50 companies are presently making PXI products.

pre-amplification. It can also be used to provide a direct high power LO input to high-performance frequency converters and modulators. In addition, the 3026C can solve the problem of test systems where test-fixture losses are high.

The 3021C RF signal generator has a frequency range of 100 kHz to 3 GHz. This unit offers the same performance specifications as the 3026C, but with an extended low-end frequency range and a more economical price tag for applications below 3 GHz.

Aeroflex
www.aeroflex.com

400/500-MSPS PCIe Data Acquisition Boards

Ultraview Corporation announces 14 bit/400 MSPS and 12 bit/500 MSPS PCIe data acquisition boards, allowing uninterrupted full-speed acquisition into host memory or to the 8 GB of on-board RAM. A combination of speed, reconfigurable processing, and very deep on-board memory enable new data acquisition capabilities in SIGINT, surveillance, missile testing, RADAR and other defense, scientific, and medical applications. When installed in any PCIe ×16 or ×8 slot, these ADC Boards can continuously acquire wideband data, optionally process it in the on-board Virtex-5™ FPGA, buffer it in the 8 GB on-board RAM, and continuously stream data to host system RAM for immediate use, graphical display, or storage. A TTL selective recording input allows acquisition to be dynamically stopped and started, increasing effective memory depth by storing only needed data, for applications such as RADAR, burst communication, and pulsed-spectroscopy.

Designed for high speed, low-jitter, operation in critical applications, these ADC boards allow either straight data acquisition requiring no user development, or in-line dataflow processing using the on-board Xilinx Virtex-5 FPGA (XC5VLX50T standard, with OEM option for any 1136-pin Virtex-5TM up to XC5VLX155T). For use as a standard DAQ board the supplied user software and device driver allow users to acquire, view, and store data with only minutes required to setup the board.

Drivers, user software, and example user source code are supplied for both 64-bit Linux and 32-bit and 64-bit Windows Vista™/XP™. Graphical waveform display software, and routines to store data to disk are included with all boards, in C-language source and ready-to-run executable form. The host-uploadable firmware capability lets users reconfigure the onboard FPGA through the host system's PCIe bus, without a programming cable, allowing OEMs to quickly, and even

remotely, modify the board's standard data acquisition VHDL firmware to perform advanced application specific hardware signal processing, including filtering, sub-band tuning, averaging, spectroscopy, SDR and image processing. This modular VHDL source is available to OEM users under NDA.

Ultraview Corporation
www.ultraviewcorp.corp

Standards Organizations

VXI Consortium: www.vxibus.org
LXI Consortium : www.lxistandard.org
PXI Systems Alliance: www.pxisa.org