

The Japanese NICT uses Lyrtech technology for airborne experiments

In April 2004, the Communications Research Laboratory (CRL) and the Telecommunications Advancement Organization (TAO) of Japan merged to form the National Institute of Information and Communications Technology (NICT). The NICT was established to conduct research and development in the fields of information and communication technology, with the aim of supporting the information and communication society of the 21st Century.

The CRL's strengths were that it conducted both basic and applied research in the fields of information and communication technology, while the TAO's strengths were that it conducted practical research and development in cooperation with industries and academic institutions for the practical application of information and communication technologies. Building on these strengths has allowed the NICT to provide various forms of assistance to researchers in the private and academic sectors, as well as subsidies to enterprises in the communications and broadcasting field.

Problem

The NICT wanted to develop a system to conduct airborne research on array antennas. Array antennas are multiple-element antennas that allow higher-bandwidth wireless communications and provide additional functionalities over traditional antennas, such as mobile user location. This was conducted as part of a larger project involving the development of a communication system using high-altitude (approx. 20 km) platform stations that would form a network providing a battery of new services to users.

The system necessary to this airborne research would require an extremely powerful signal processing system to achieve real-time data acquisition and



processing. The system would also have to be small enough to fit inside a commercial helicopter.

Solution

The NICT elected to entrust Lyrtech with the development of a signal processing system for their experiments. Lyrtech chose to develop a signal processing system based on its high-performance SignalMaster digital signal processing/field programmable gate array platform, and to create the data acquisition process with Simulink®, software for simulation and model-based design of dynamic systems.

The system thus consists of a SignalMaster DSP/FPGA platform, combined with HS-ADC16 and HS-DAC16 modules. These modules allowed the NICT to develop a high-performance multichannel input/output system. The input/output modules consist of two compact PCI boards, each with 8 (or 16 with optional daughter boards), 105 MSPS, 14-bit AD and DA channels, as well as 1 to 8 Mbytes for preprocessing.

Problem

Develop an efficient signal processing system for a Japanese experimental array antenna system.

Solution

Use the SignalMaster DSP/FPGA platform as a processing system to acquire and process data in real time.

Results

- " Time and money saved.
- " Reliable system.
- " Fast and precise system.
- " Compact system



Success Story

Further processing is done on additional SignalMaster FPGA/DSP compact PCI boards. Data is transferred between the boards through a front panel data port (FPDP).

"We are familiar with MATLAB/Simulink, so we can easily program the DSP. The Simulink-based programming is very helpful when we need to change the program in the field. This feature can also save us programming time. The SignalMaster that we used for the experiment is so compact, even though it has 16 high-speed AD/DA channels, it was very easy to fit into the experimental system. Therefore, we found that the SignalMaster is one of the most powerful tools in our equipment."

NICT development team

Experiments allowed the successful acquisition of experimental data to evaluate the direction-of-arrival algorithms. These algorithms are a basic function of array antennas and they allow the estimation of the angular direction of other transmitting systems. This angular direction is used to locate terminals and "beam form" the antenna pattern to electronically point it, thus obtaining the maximum gain in the direction of potentially mobile transmitting systems.



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Results

Time and money saved.

Using a system with which the Japanese were already familiar allowed them to quickly develop, validate, and simulate FPGA processing prior to bit-stream synthesis and real-time testing.

Reliable system.

The Lyrtech FPGALink, a unique FPGA hardware-in-the-loop bit-stream co-verification tool provides a valuable FPGA verification step prior to real-time testing.

Fast and precise system.

The 16 high-speed AD/DA channels of the SignalMaster allow algorithms to determine the direction of arrival of waves from mobile transmitters in real time, yielding great precision.

Compact system.

Despite its 16 high-speed AD/DA channels, the SignalMaster is very compact, allowing it to be mounted on a commercial helicopter for testing.

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