LabVIEW DSP Module for NI SPEEDY-33 and TI DSKs

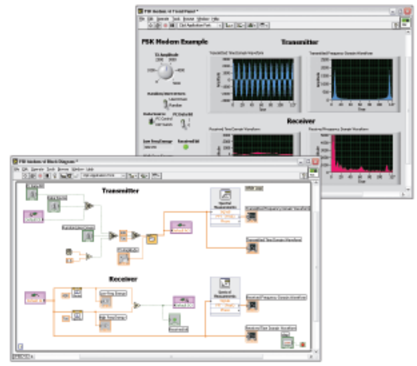
LabVIEW DSP Module

- Intuitive, graphical environment facilitates rapid application development
- Addresses many applications with extensive function library
- Interacts in real time with application running on a DSP
- Implements filters created with the LabVIEW Digital Filter Design Toolkit
- Helps you focus more on experimenting with and teaching concepts and less time on teaching tools

Operating Systems
- Windows 2000/XP

Required Software
- LabVIEW 7.1

Compatible Hardware
- NI SPEEDY-33
- Texas Instruments C6711 DSK
- Texas Instruments C6713 DSK



Product	Bus	Power	Codec resolution	Codec Mode	Code sampling rate	Microphones	Line in/ Line out	Digital Input	Digital Output	Real-time front panel updates
NI SPEEDY-33	USB	USB	16-bit	Stereo	48 KHz	2	✓	8 DIP	8 LEDs	✓
TI C6713 DSK	USB	Ext	24-bit	Stereo	96 KHz	–	✓	4 DIP	4 LEDs	–
TI C6711 DSK	PII.	Ext	16-bit	Mono	8 KHz	–	✓	4 DIP	3 LEDs	✓

Figure 1. NI SPEEDY-33

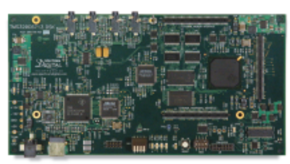


Figure 2. TI C6713 DSK by Spectrum Digital

Overview

The National Instruments LabVIEW DSP Module offers DSP-based algorithm and system design, implementation and analysis. You can apply the concepts of digital signal processing techniques, such as spectral analysis or filtering, using the LabVIEW graphical programming environment on a DSP so you can focus on concepts and results rather than tedious implementation details. The NI LabVIEW DSP Module adds features to LabVIEW that focus on creating signal processing applications that run on DSPs.

For the Classroom

The LabVIEW DSP Module provides students with a positive hands-on DSP experience that increases their enthusiasm for the subject matter. Because students use graphical programming methods to learn and develop applications, they can use the LabVIEW DSP Module to quickly implement DSP fundamentals on supported DSP hardware without having to write any C, assembly or script source. Students benefit from the simplicity and usability of the LabVIEW DSP Module while still being exposed to leading-edge DSP design tools.

Rapid Prototyping Environment

By using a graphical programming environment such as the LabVIEW DSP Module for DSP applications, you can greatly reduce your time to market because the LabVIEW DSP Module facilitates rapid prototyping of your DSP applications on supported DSP hardware, which reduces design and development time. The graphical nature of the LabVIEW DSP Module helps create more maintainable and modular code. These advantages give you the edge you need in order to create innovative DSP applications faster.

DSP Targets

The LabVIEW DSP module supports several targets including the NI SPEEDY-33, Texas Instruments TMS320C6713 DSK and TMS320C6711 DSK. The DSP Module addresses the ADC (analog-to-digital converter), DAC (digital-to-analog converter), or digital I/O on the DSP target to perform single-point or multi-sample operations. You can configure the port, timing, buffer size, and several other features to suit your application needs. When you switch to another supported DSP hardware, the I/O nodes automatically change the underlying implementation for the new DSP target accordingly.

Application Areas and Analysis

The LabVIEW DSP Module addresses engineering-related challenges in which DSPs are widely used. In addition to using the LabVIEW DSP Module to teach fundamental DSP concepts running on DSP hardware, you also can build communications systems, audio processing and complex motor control applications.

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Other application areas include:
- Communication
- Modulation and demodulation
- FIR (Finite Impulse Response)
- IIR (Infinite Impulse Response)
- Digital and LMS (least-mean-square) filtering
- Speech processing/analysis
- Noise analysis
- Cross correlation
- Information processing

Figure 3 shows how a typical DSP application is built using the LabVIEW DSP Module. After you create your DSP VI, you compile and download it to the chosen hardware target. The code is very compact and efficient, with most applications fitting within the 32 KB words of available memory. With the NI SPEEDY-33 and TI C6711 DSK and C6713 DSK targets, you can download your DSP VI to flash memory to create a true embedded application.

One of the advantages of graphical programming with the LabVIEW DSP Module is the LabVIEW front panel, which is an interactive user interface of a DSP VI. As you are creating your DSP VI, it is easy to add controls and indicators to interactively debug and validate your code. The NI SPEEDY-33 target uses a USB connector to an SPI adapter on the board. The TI C6713 DSK target uses a USB connector to a JTAG emulator on the board.

Front panels and block diagrams in LabVIEW create reusable and modular application code. Use the front panel to define inputs and outputs to your hierarchical application code. Modular code can help reduce the time it takes to develop and debug your embedded application, which reduces your time to market.

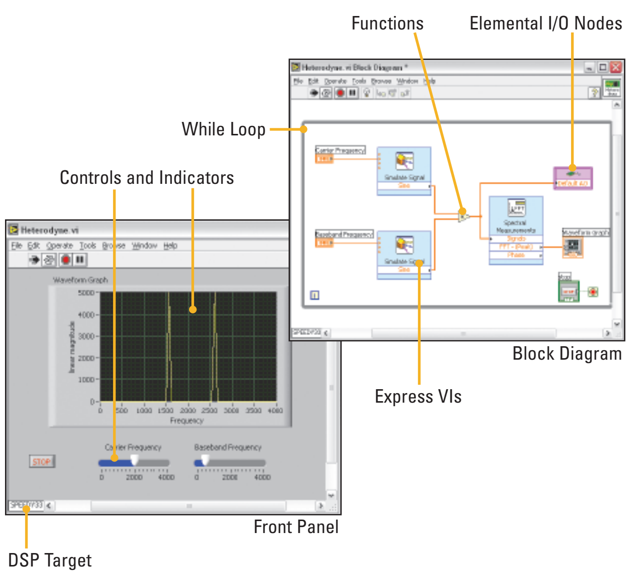


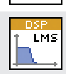
Figure 3. Implementing a Heterodyne System using LabVIEW DSP

Function Descriptions and Highlights

Elemental I/O Nodes

	Analog Input	Reads from the Analog Input that you specify in the Configure Elemental I/O dialog box. Configure the analog input function to read the analog input channels connected to a LabVIEW DSP target.
	Analog Output	Writes to the Analog Output that you specify in the Configure Elemental I/O dialog box. Configure the analog output function to write to the analog output channels connected to a LabVIEW DSP target.
	Digital Input	Reads from the Digital Input Line that you specify in the Configure Elemental I/O dialog box. Configure the digital input function to read the digital input line connected to a LabVIEW DSP target.
	Digital Output	Writes to the Digital Output Line that you specify in the Configure Elemental I/O dialog box. Configure the digital output function to write to the digital output lines connected to a LabVIEW DSP target.
	Digital Bank Input	Reads from the Digital Bank Input Lines that you specify in the Configure Elemental I/O dialog box. Configure the digital bank input function to read the digital bank input signals from a LabVIEW DSP target.
	Digital Bank Output	Writes to the Digital Bank Output Lines that you specify in the Configure Elemental I/O dialog box. Configure the digital bank output function to write to the digital bank output signals of a LabVIEW DSP target.

Filter VIs

	Filter	Processes signals to simple filters. Choose from low-pass and high-pass filters. You can also choose the number of taps if you are implementing an FIR filter or from a variety of topologies if you are implementing an IIR filter.
	DFD Filter	Processes signals through filters constructed using the Digital Filter Design Toolkit.
	Biquad	Applies a biquad transfer function to an input signal. Use a biquad to define a 2-pole, 2-zero digital filter.
	LMS Adaptive Filter	Applies a least mean square (LMS) adaptive filter algorithm.

Transform VIs

	Real FFT	Computes the fast Fourier transform (FFT) of an input sequence.
	Inverse Real FFT	Computes the inverse fast Fourier transform (FFT) or the inverse discrete Fourier transform (DFT) of the input sequence FFT {X}.
	FHT	Computes the fast Hartley transform (FHT) of an input sequence.
	Inverse FHT	Computes the inverse fast Hartley transform of an input sequence.
	Fast Hilbert Transform	Computes the fast Hilbert transform of an input sequence
	Inverse Fast Hilbert Transform	Computes the inverse fast Hilbert transform of the input sequence using Fourier identities.
	Goertzl	Implements a second order filter that extracts the energy present at a specified frequency.

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Window VIs

	Hamming Window	Applies a Hamming window to an input signal.
	Hanning Window	Applies a Hanning window to an input signal.
	Flat Top Window	Applies a flat top window to an input signal.
	Kaiser-Bessel Window	Applies a Kaiser-Bessel window to an input sequence.
	Low Sidelobe Window	Applies a Blackman window to an input signal.
	Blackman Window	Applies the Blackman window to an input signal.
	Exact Blackman Window	Applies an exact Blackman Window to an input signal.
	Blackman-Harris Window	Applies a 3-term Blackman Harris window to an input signal.
	7-term B-Harris window	Applies a 7-term Blackman Harris window to an input signal.
	4-term B-Harris window	Applies a Blackman-Harris 4 term window to an input signal.

Time Domain VIs

	Sample Delay	Delays a signal by the specified number of samples.
	Variable Sample Delay	Delays a signal by varying number of samples.
	Convolution	Computes the convolution of the input sequences X and Y.
	Crosscorrelation	Computes the cross correlation of the input signals X and Y.
	Automatic Gain Control	Automatically adjusts the gain or amplification of a signal. Use this VI for automatic scaling of the VI.
	Y(i)=x(i)-n	Shifts the elements in the Input Array by the specified number of shifts.
	Y(i)=clip(x(i))	Clips the elements of Input Array to within the bounds specified by upper limit and lower limit.
	RMS	Computes the root mean square (rms) of the input sequence X.
	Half wave rectify	Removes the negative parts of the signal. The negative parts are replaced by 0.
	Full wave rectify	Changes any negative portion of the signal to positive.

Embedded Signal Generation VIs

	Simulate Signal	Simulates a sine wave, square wave, triangle wave, sawtooth wave or noise (D.C.) signal.
	Frequency Sweep Generator	Generates a sweeping sine waveform.
	Sine Waveform	Generates a waveform containing a sine wave.
	Square Waveform	Generates a waveform containing a square wave.
	Triangle Waveform	Generates a waveform containing a triangle wave.
	Cosine Waveform	Generates a cosine waveform.
	Sawtooth Waveform	Generates a waveform containing a sawtooth waveform.
	Uniform White Noise Waveform	Generates a uniformly distributed pseudorandom pattern whose values are in the range [–a:a], where a is the absolute value of amplitude.
	Gamma Noise Waveform	Generates a pseudorandom pattern of values, which are the waiting times to the order number event of a unit mean Poisson process.
	Poisson Noise Waveform	Generates a pseudorandom sequence of values, which are the number of discrete events occurring in the interval specified by mean of a unit rate Poisson process.
	Binomial Noise Waveform	Generates a binomially-distributed pseudorandom pattern whose values are the number of occurrences of an event given the probability of that event occurring and the number of trials.
	Constant Generator	Generates a constant DC waveform. You can use this VI to produce a DC waveform signal for a sample rate system that is controlled by sample rate.
	Sinc Pattern	Generates an array containing a sinc pattern.
	Ramp Pattern	Generates an array containing a ramp pattern.
	Impulse Generator	Generates an array containing an impulse pattern.

Frequency Domain VIs

	Spectral Measurements	Perform spectral measurements, such as peak spectrum and power spectrum on a signal.

Ordering Information

NI LabVIEW DSP Module (academic only) 779430-03
NI LabVIEW DSP/NI SPEEDY-33
Bundle (academic only)...778010-23

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For complete product specifications, pricing, and accessory information, call (800) 813-3693 (U.S. only) or go to **ni.com/dsp**.

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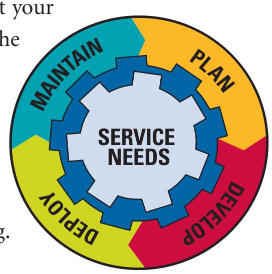

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