



for Creation, Analysis, and Processing of  
Signals and related applications

## Implementation Details

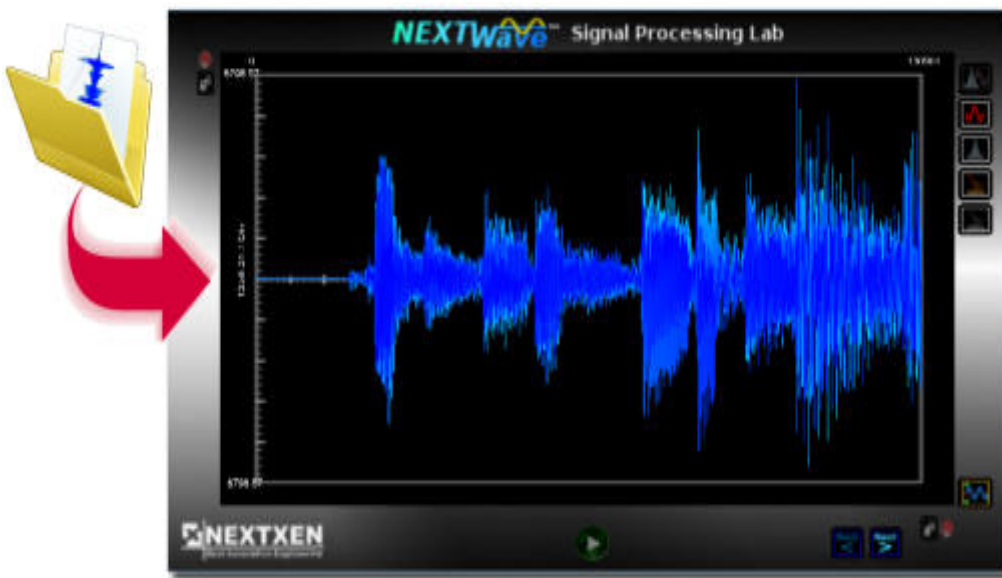
<b>Standard Interoperability</b>	<b>2</b>
How easy is it to work with my existing data, or integrate existing tools with NEXTWave SPL?	
<b>Intuitive User Interface</b>	<b>3</b>
How easy is it to use NEXTWave SPL?	
<b>Analysis Options</b>	<b>8</b>
What type of displays and measurements can I create with my data?	
<b>Frequency Domain Transforms</b>	<b>11</b>
What options do I have to look at my signal in the frequency domain?	
<b>Processing Capabilities</b>	<b>12</b>
How do I process data (perform DSP) with NEXTWave SPL?	
<b>Real-time Acquisition</b>	<b>14</b>
How do I get real world signals/data into NEXTWave SPL?	
<b>Functions</b>	<b>15</b>
What functions are included?	
<b>Applications</b>	<b>16</b>
What are the types of things can I do with NEXTWave SPL?	

NEXTXEN is confident that its NEXTWave software product line is of great value to virtually all engineers and scientists involved in signal processing and data analysis, and that it serves as a useful tool in the academic arena for conveying underlying signal processing principles and concepts to students.

# Standard Interoperability

## Importing and Exporting Your Data

NEXTWave SPL was designed to easily use your data - no matter how it was originally gathered or generated. Direct use of binary file data (in a variety of formats) is supported, as well as the importation of ASCII type data, .wav files, and .mp3 files. Importing data into the NEXTWave SPL environment can be accomplished via standard file browsing as well as drag-and-drop selections. With NEXTWave SPL your data can undergo further signal processing and analysis. Processed data and newly created signals are instantly available so that they can be exported in a variety of file formats for use by other software tools.



**Drag-and-Drop existing files**

## Working with Other Software

NEXTWave SPL supports a wide variety of binary data formats - both coming in and going out. This capability allows generated and processed data to be used by other standard signal processing software. The specific data format to choose when exporting data will likely depend upon the application - binary float and binary integer are typical data formats. NEXTWave's data import and export options and its use of standard binary file formats allows you to exchange data with your own custom software as well.

### Drag-and-drop

NEXTWave SPL supports the use of drag-and-drop data import. Dragging an external file of a supported data format will result in the waveform data being automatically loaded into the environment. The drag-and-drop approach involves using the mouse to select a filename from a known location on the computer and then dragging the filename on top of the NEXTWave waveform display and then releasing the mouse button. Upon successful use of the drag-and-drop method a dialog box will appear in which configuration parameters such as file format, sample rate, and analysis frame size are confirmed.

### Data File Formats Supported

NEXTWave implements all internal algorithm calculations based upon floating-point arithmetic. Intermediate data file storage is kept in binary floating-point data files. File-based support for the following data types are allowed:

- Binary Double
- Binary Floating-point
- Binary 8-bit Integer
- Binary 16-bit Integer
- Binary 32-bit Integer
- Binary 64-bit Integer
- Import of Windows WAV File Format and MP3 File Format
- Import of ASCII Data Files

# Intuitive User Interface

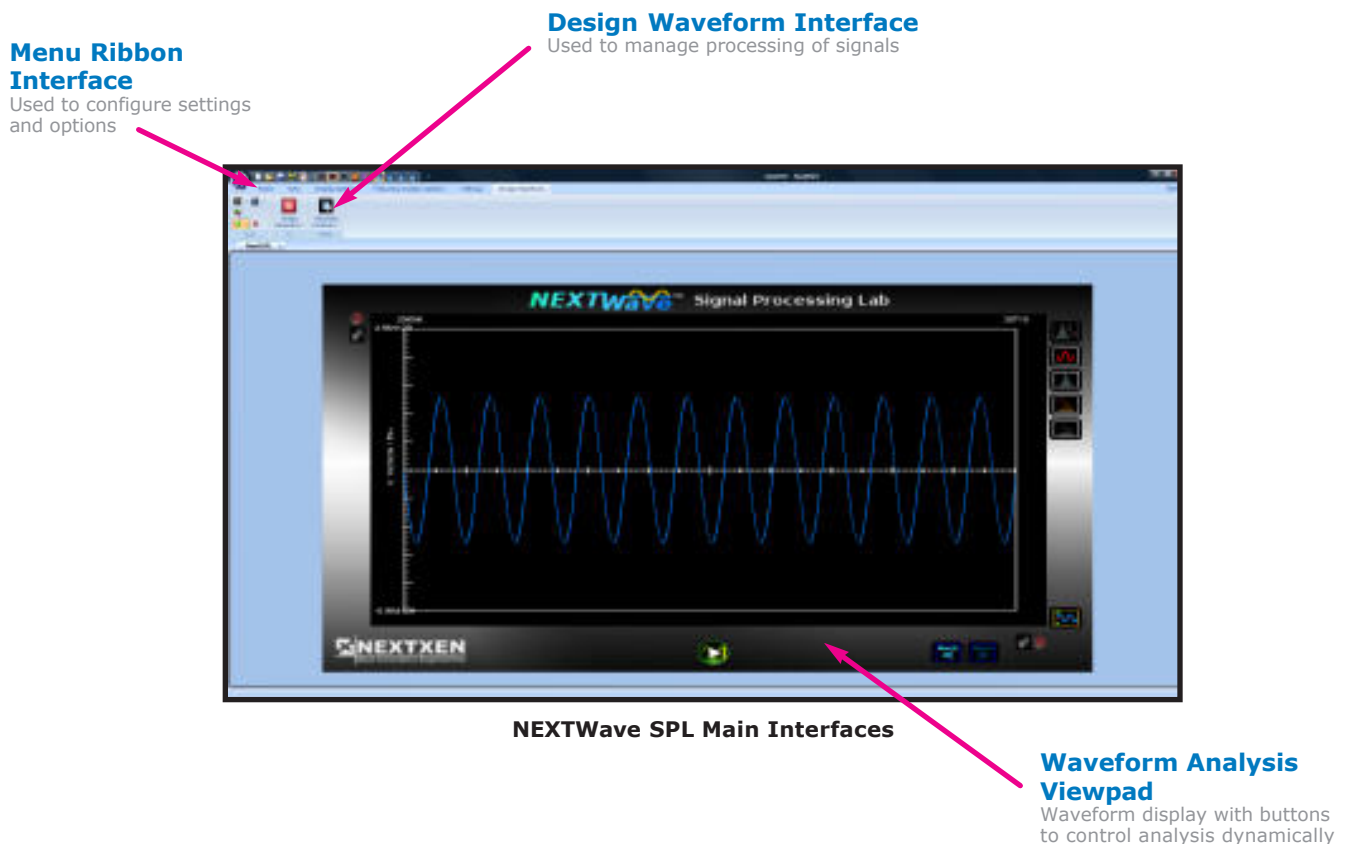
## User Interface

The NEXTWave SPL software user interface is graphical in nature. It consists of three main work areas - the Menu Ribbon interface, the Design Waveform interface (a subset of the Menu Ribbon), and the Viewpad interface. These three areas are used together to configure the environment, create algorithms to operate on data, and to analyze data. The combination of these elements allows for a quick and efficient means of working with signals.

## Software Environment

NEXTWave SPL relies upon the standard Menu Ribbon interface to allow for its configuration and selection options. The Viewpad interface is used for data analysis and display capabilities. It contains virtual buttons and other interface features that allow for the dynamic changes to the Viewpad. The Design Waveform interface is used to program signal processing and other algorithms that operate on the data, the results of which are made immediately available to the Viewpad.

The Viewpad can be oriented into different positions easily with use of keyboard commands as well as with a mouse interface. It provides the ability to zoom-in and zoom-out on any section of waveform data for enhanced analysis and display. This, in conjunction with its innovative full rotation capabilities, provides for limitless combinations to enhance the waveform display and analysis experience.



# Intuitive User Interface

## Intuitive User Interface

The NEXTWave SPL user interface benefits from the transparent interaction between its Viewpad display and its programming interface. The graphical nature of the environment ensures that data analysis and signal processing can be achieved without requiring the user be an expert programmer. Data flow for all algorithm processing is determined automatically. This approach simplifies the design cycle throughout concept to final implementation. This ease-of-use approach yields a signal analysis and processing environment that is both powerful and user friendly.

### Menu Ribbon Interface

NEXTWave SPL allows for user-selectable configuration options that control how data is handled and displayed. The interface enables user control over general viewing options, waveform display options, frequency analysis options, and global settings. Built-in functions such as frequency transforms are easily adjusted through the menu ribbon interface.

### Viewpad Display

NEXTWave SPL data is represented graphically on the Viewpad display. Axis scaling is indicated with numerical labels, and a measurement grid is available to assist in data analysis. The Viewpad serves as the focal point for viewing and analyzing data. It provides a variety of analysis displays and allows for control over data panning, waveform zoom, data scaling, waveform orientation, and marker analysis.

The Viewpad appears as a floating three-dimensional virtual display device. It can be user-manipulated to yield a variety of visual options that can enhance the graphical display of user data. Limitless viewing angles and approaches enable the user to analyze waveform data in greater detail.

The Viewpad also contains virtual control buttons that govern any signal processing being performed, thereby providing control over algorithms in an active, running fashion. The live, quick response of the Viewpad display offers a 'real-time' feel while studying signals.

### Design Waveform Interface

All programmable capabilities are achieved through the flexible Design Waveform programming interface. Signal creation/modification can be accomplished by combining various signal processing algorithms in a sequence, and then made to operate on the data (which may be file-based, prior processed data, and/or continuously acquired real-time data). This interface allows for an intuitive means of constructing an algorithm to operate on a data stream. The entire algorithm and data flow is displayed and is easily seen and understood. Individual functions are represented by icons and are shown together on the Design Waveform menu ribbon. These functions each operate on an input data stream to produce a generated output data stream that is the result of the algorithm's execution. Individual parameters for each function can be user-adjusted on-the-fly to alter the operation of the user's algorithm.

### Quick Access Toolbar

A standard Quick Access toolbar at the top of NEXTWave SPL facilitates processing and analysis operations.

### Mouse and Keyboard Commands

Convenient mouse and keyboard commands allow for quick navigation and positioning within the NEXTWave SPL environment.

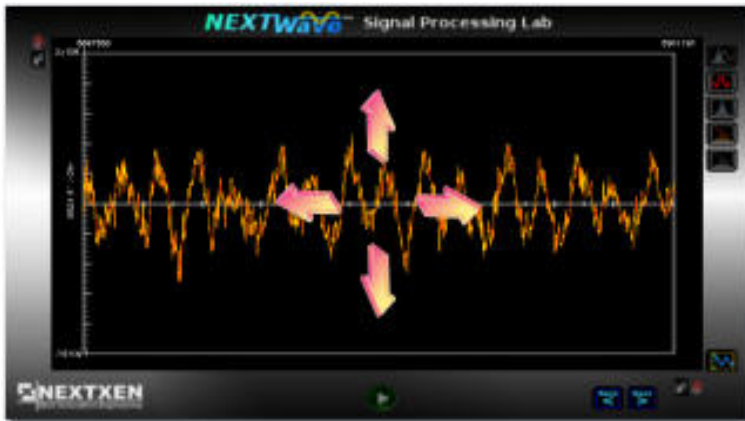
### Command Line Interface

A command-line interface allows NEXTWave SPL to be controlled externally by third-party applications or your own custom software.

# Intuitive User Interface

## Gesture-Based Waveform Manipulation

NEXTWave SPL provides a variety of ways in which to interact with waveform signals. This high-level of control allows waveforms to be easily navigated using gesture-based movements of the mouse. This interface mimics the touch control of tablet-based computers.



**Gesture-based Waveform Manipulation**

### Panning a Waveform

The Viewpad display shows a frame of data, the size of which is dependent upon conditions determined by the user. The ability to pan/scroll through the waveform so that other portions of the signal can be viewed is achieved via several methods. Frame-based Back and Next buttons can be selected to scroll through a waveform by a fixed number of samples. The frame labels indicators can also be 'clicked-on' to show a new section of the waveform. Additionally panning through displayed waveform data can be done by using mouse control.

### "Hold & Drag" for Controlled Positioning

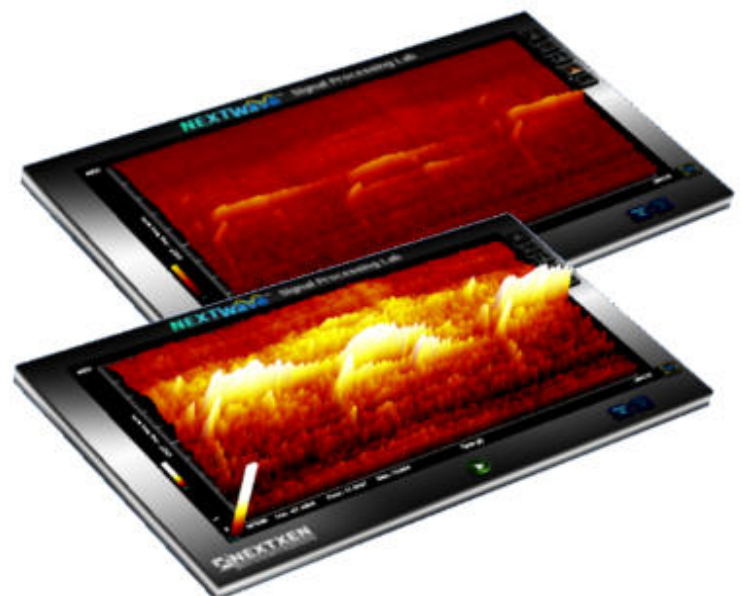
This method of waveform manipulation allows for a controlled positioning of data within the Viewpad display. It can be implemented by simply placing the mouse cursor into the Viewpad and then pressing and holding the mouse's left-button while moving the mouse slowly in a chosen direction. For example, moving the mouse slowly towards the left will result in the waveform being panned to reveal data samples from the right.

### "Waveform Throw" for Rapid Positioning

The waveform throw is a gesture-based movement that allows for a rapid positioning of the waveform within the Viewpad. This is done by placing the mouse cursor into the Viewpad display and then while pressing and holding the mouse's left-button quickly moving the mouse in a desired direction and letting up. The speed and direction of the throw is governed by the speed of the mouse. Using the waveform throw allows for convenient navigation within large data sets.

### Spectrogram Range Manipulation

The duration of time shown on a Spectrogram Display can be adjusted by the user via both mouse and keyboard commands to increase or decrease the amount of time displayed. The spectrogram floor can be raised or lowered conveniently by both mouse and keyboard commands. The spectrogram scale can also be user-adjusted to help highlight regions of interest.



**Spectrogram Range Manipulation**

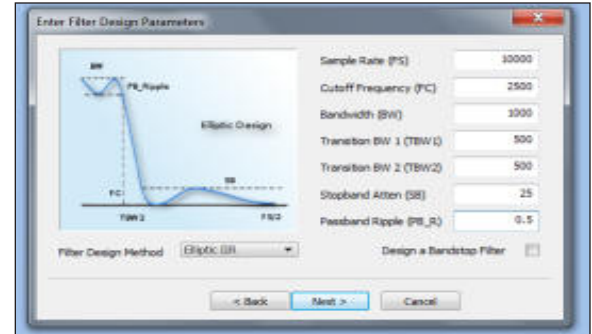
# Intuitive User Interface

## Tagging Waveform Data

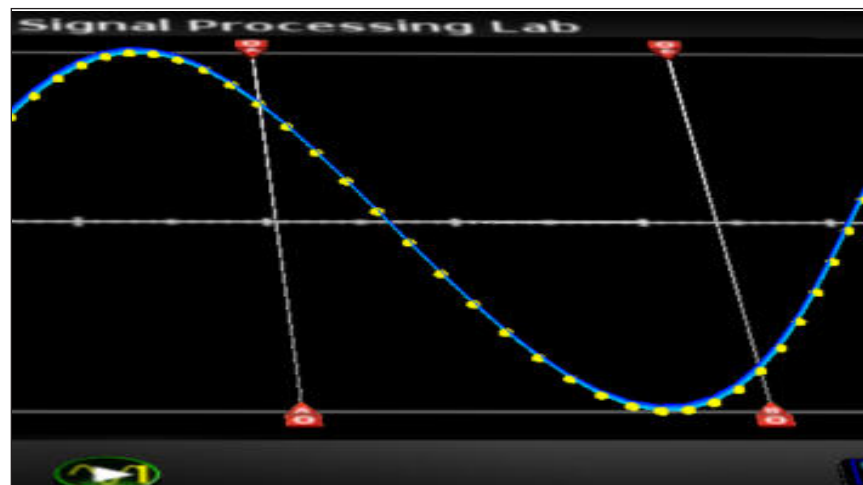
The ability to attach a text-based note to a displayed waveform at a particular point in time is provided. The waveform tag is shown on the Viewpad display alongside the data. This capability allows the user to add customized notes and observations to any data sets that are of relevant interest. After a tag is added to a waveform its position is fixed to its time-stamp location independent of time-domain or frequency-domain graphs. Scrolling/panning through the waveform does not change its location - the tag will move in step with the waveform. Multiple tags can be assigned.

## Using External Slider Controls

An individual parameter for a function can alternately be governed by either an edit control box, or a graphical slider so that its value can be user-adjusted via mouse control while the algorithm is running.



Template Wizard helps you get started

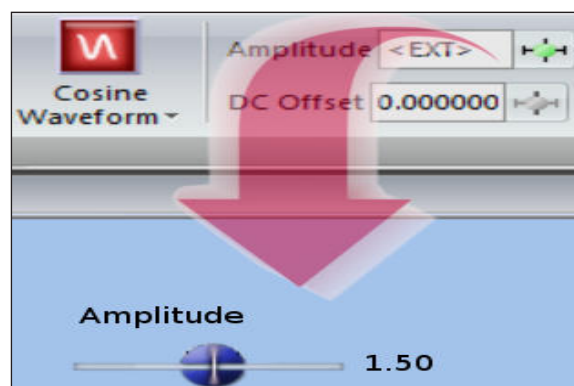


Marker Measurement of a Signal

Selecting the slider bar button located adjacent to a function's parameter edit control box will result in the automatic placement of an external slider control on the NEXTWave workspace (see below).

## Autoscale and Auto-ranging

Autoscale and Auto-ranging buttons provide automatic scaling to the waveform displayed in the Viewpad. The Autoscale feature is applied only one time to the data currently displayed in the Viewpad when it has been selected, while the Auto-ranging continuously updates scaling to keep the waveform in range.



Slider Controls

## Heads Up Display

The Heads Up Display provides detailed information about any data output and algorithm that is being executed. This information appears on-screen and updates continuously.

## Probing the Output of a Wavestrip Function

NEXTWave SPL allows individual functions contained in the Design Waveform menu ribbon to be probed so that the user can display and analyze the data at any point of programming.

Positioning the mouse cursor over any function will result in it's data output to automatically be displayed on the Viewpad. Moving the mouse cursor off of the function being probed will result in the Viewpad reverting to display the main output data stream.

## Markers for Measurements

Waveform marker pairs are available for data measurement, data export to file, and real-time data generation to DAC. The markers adhere to gesture-based mouse movements.

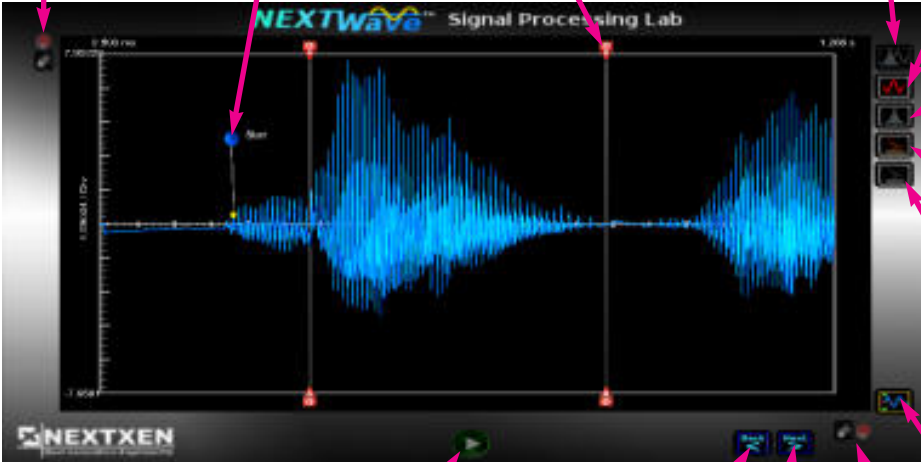
## Convenient Template Wizard

A Template Wizard is included to quickly create new applications from preexisting design types. A series of walk-through screens allow the user to select an application area that most closely resembles their own, and automatically create a working prototype. This capability is can be useful for jump-starting an application at the early stages of development.

# Intuitive User Interface

## The Viewpad Interface

NEXTWave SPL software provides several different menu controls that can be used to affect the manner in which data is displayed on the Viewpad. These controls are shown below:



The image shows a screenshot of the NEXTWave SPL Viewpad interface. The main display area shows a blue waveform on a black background. The interface includes a top menu bar with 'NEXTWave™ Signal Processing Lab' and a bottom control bar with various buttons. Red arrows point from text annotations to specific controls on the interface.

**Vertical Lock**  
Ensures vertical scale is the same for multiple waveforms

**Tags**  
Tags can be 'attached' to the signal being viewed; they remain fixed to the waveform at a particular time stamp

**Markers**  
Turn markers on to measure at a particular location

**Time/Frequency Overlay**  
The Time/Frequency Overlay display option will cause the Viewpad to overlay both time and frequency waveform displays

**Time**  
The Time display button will cause the Viewpad to display data in its time-domain representation

**Frequency**  
The Frequency display button will cause the Viewpad to display data in its frequency domain representation using the currently selected transform

**Spectrogram 1**  
The Spectrogram 1 display button will display waveform data as a spectrogram using the currently selected transform - magnitude of the data is represented in the spectrogram as a color-based intensity scale

**Spectrogram 2**  
The Spectrogram 2 display button will display waveform data as a spectrogram using the currently selected transform - magnitude of the data is represented in the spectrogram as a monochrome-based intensity scale

**Autoscale**  
The Autoscale button provides automatic scaling of a waveform

**Horizontal Lock**  
Ensures horizontal scale is the same for multiple waveforms

**Next Frame**  
Allows the next frame of data to be viewed

**Previous Frame**  
Allows the previous frame of data to be viewed

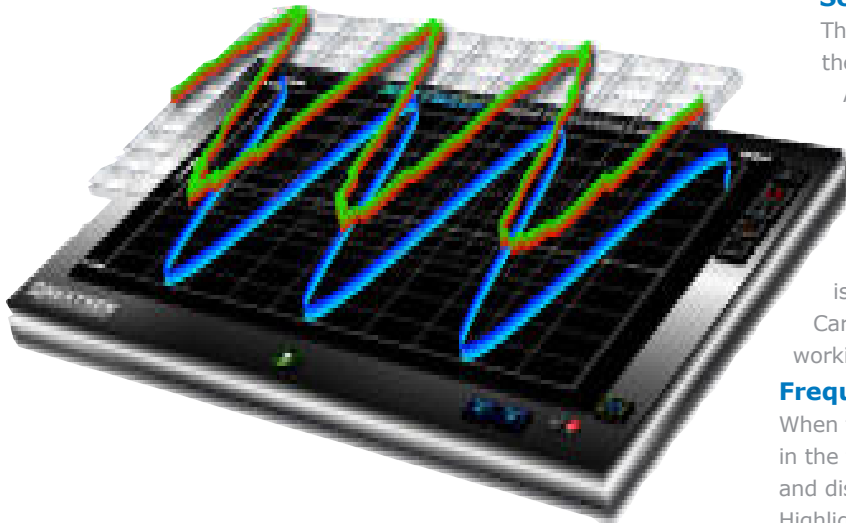
**Run**  
Begins the generation, processing, or acquisition of signals

NEXTWave SPL Viewpad

## Annotations

Annotations are labels that are fixed to a selectable 3D location anywhere in the NEXTWave SPL virtual world

# Analysis Options



Example of Overlay with Z Offset

## Overlay Mode

The Overlay Mode can be used to cause the Viewpad to overlay multiple waveform data on the same X-Y-Z grid axis. This mode is only enabled for selection when multiple data channels are available for display. Waveforms are overlaid on the X-Y axis in both Time Domain and Frequency Domain Viewpad displays.

## Overlay Z Offset

The Overlay Z Offset can be enabled to allow the Time Domain and Frequency Domain Viewpad displays to apply an offset value to the Z axis so that multiple waveforms can be viewed as overlaid data on the X-Y axis, but on a different Z-plane. The method of overlay provides a powerful compare and contrast analysis between data sets.

## Special Complex Mode

The Special Complex Mode governs the manner in which complex data is represented in the Viewpad display. When this option is enabled complex data is represented on the Viewpad display in X, Y, and Z planes. If Special Complex mode is disabled then complex data is represented on the Viewpad display in X and Y planes.

## Burn-Through Mode

When enabled the Burn-Through mode will cause the waveform being displayed on the Viewpad to also be represented on the back of the Viewpad such that the waveform data can be seen "from behind" when the Viewpad is rotated.

## Scaling Options

The Autoscale button provides an automatic "fitting" of the waveform data displayed in the Viewpad. The Autoscale feature is applied immediately one time when it has been selected. Symmetric Rails, Auto-Ranging, Auto-Scale "Nice Numbers", and Auto-Max are related options that accommodate the user.

## Send Data to D/A

Any section of displayed time domain data can be isolated by waveform markers and sent to the Sound Card D/A for acoustic analysis. This is useful for those working with acoustic signals.

## Frequency Analysis Highlighting

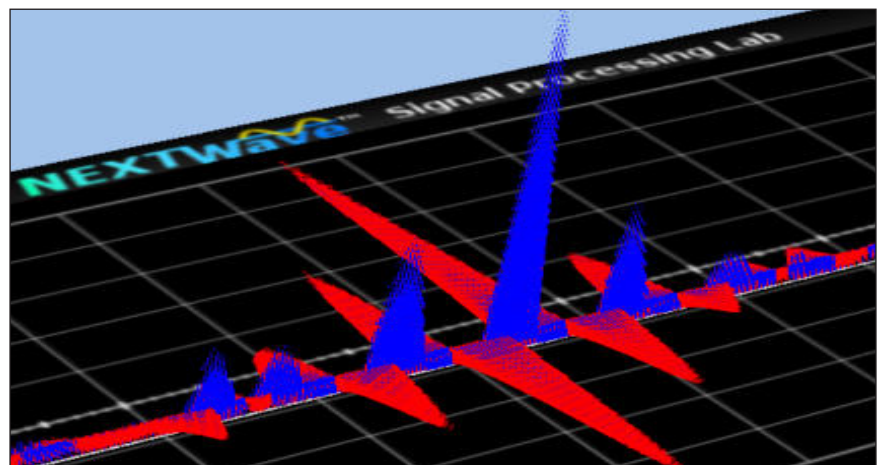
When the frequency display is active the data represented in the time domain is mapped into the frequency domain and displayed. When enabled, the Frequency Analysis Highlighting option implements a graphical highlighting of the time domain data samples that are actually used by the frequency transform. This allows for direct visualization of any zero-filling or truncation that may occur based upon the currently selected frequency transform options. The time domain samples used by the frequency domain transform are highlighted.

## Embedded Frame Markers

When enabled, the Frame Markers will result in the graphical representation of a "spike" (in the Z axis) in the Time Domain display at frame intervals that are based upon the currently selected framesize.

## Time/Frequency Grid

When selected this option will result in the appearance of a 10x10 X-Y measurement grid for both Time Domain and Frequency Domain Viewpad displays.



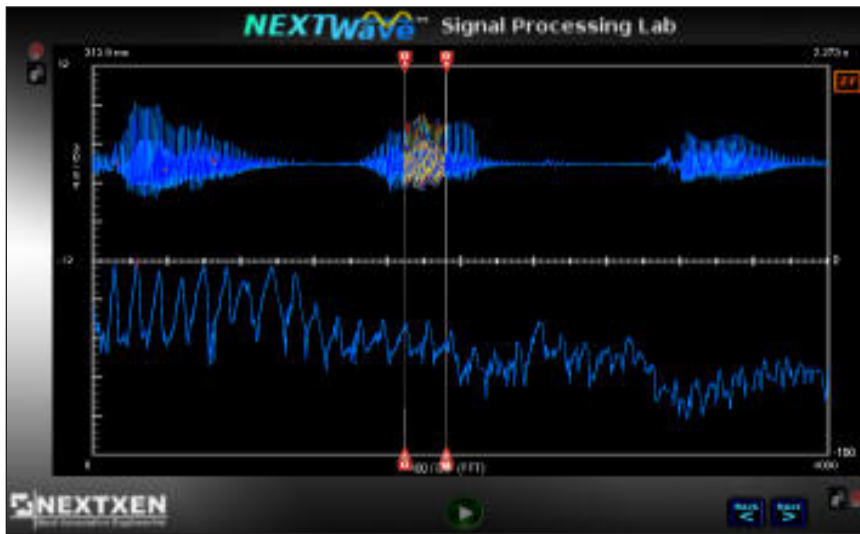
Waveform shown with Special Complex Mode



# Analysis Options

## Spectrogram 3D Grid

When selected this option will result in the appearance of an X-Y-Z measurement grid for the Spectrogram in the Viewpad display.



Frequency Analysis Highlighting

## Annotations

The Annotation option enables all text annotations that exist for the currently selected project to be displayed. Disabling the Annotation option will hide all text annotations.

## Tags

This option allows all tag entries that exist for the currently selected project to be displayed when their corresponding waveform positions are encompassed within the Viewpad. Disabling Tags will hide all tag entries.

## Marker Zoom-In

When selected Marker Zoom-In will cause the region of waveform data displayed between the marker pairs to be redrawn as the current frame of data effectively causing a "zoom-in" of the displayed data.

## Export to PDF

Several methods are provided for exporting the current display in a NEXTWave SPL work session directly to a PDF file format.

## Points on Zoom

When this option is invoked the position of the individual data samples of the time domain waveform are represented by individual graphical spheres when the number of samples displayed is less than or equal to 100 points. A continuous waveform line connects the individual data samples.

## Values on Zoom

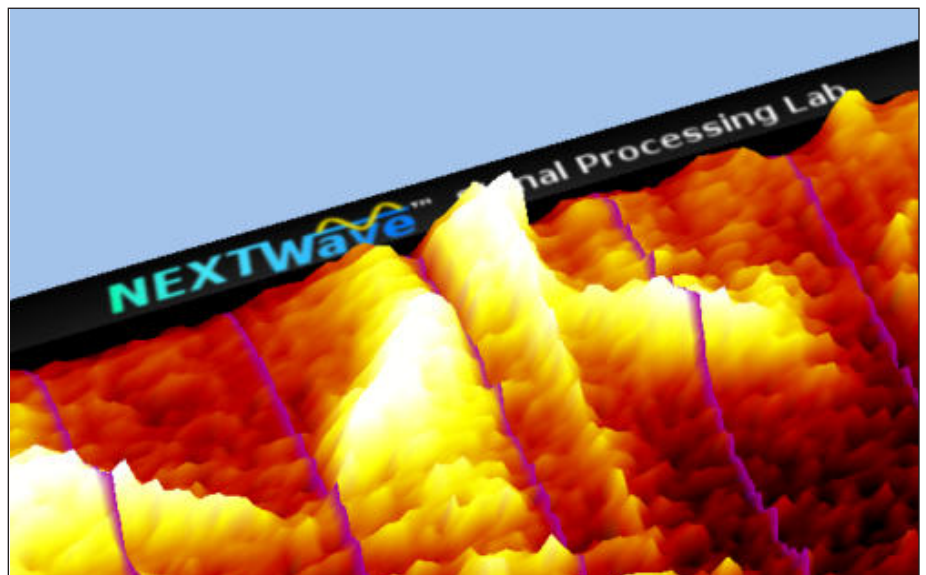
When this option is invoked the actual values of the individual data samples of the time domain waveform are displayed.

## Tumble Display Mode

The Viewpad display can be placed into a "tumble" mode where it will automatically rotate and revolve according to a predefined pattern without the need for user interaction. This allows the user to analyze the displayed waveform while it orients itself into different viewing vantage points. The Tumble Display mode can be very beneficial for studying spectrograms from a variety of time/frequency/magnitude vantage points.

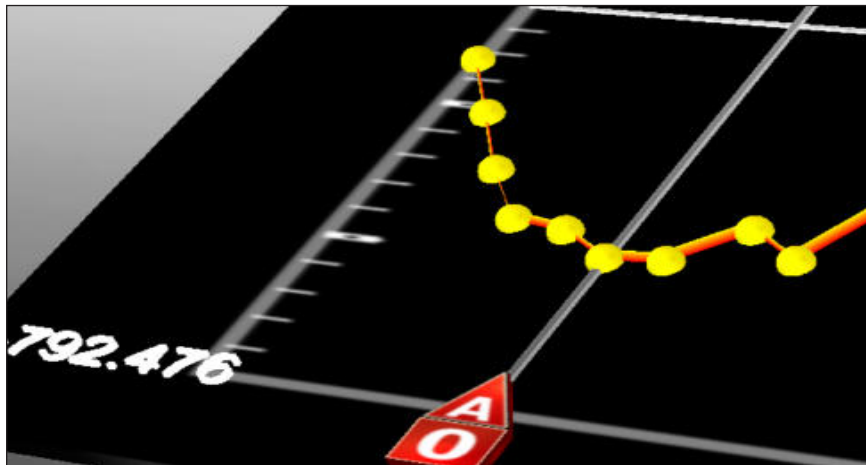
## 3D Rotation

A striking visual feature that can be achieved is the full 3D-rotational positioning of the Viewpad using the mouse. Rotation of the Viewpad can result in an enhancement of the analysis display capability. For example when a Spectrogram waveform is displayed a rotation of the Viewpad will result in the spectrogram changing in appearance from a 2D state to a 3D state.



Embedded Frame Markers

# Analysis Options



Example of Points on Zoom



Execution Control

## Execution Control: Stop/Reset/Run/Single-Step

NEXTWave SPL provides execution controls that govern the execution of any programming and the corresponding graphical display of waveform data. The Stop control is used to halt all NEXTWave SPL processing and live display. The Reset control is used to force a reset condition for all functions in use. The Run control is used to force an execution condition where programming commences and live data is displayed the Viewpad. The Single Step control will result in a single frame-by-frame execution and subsequent waveform display.

## Spectrogram Time Stamp

When enabled the Spectrogram Time Stamp will show graphical marks at one second intervals in the spectrogram displays.

## Vertical Lock

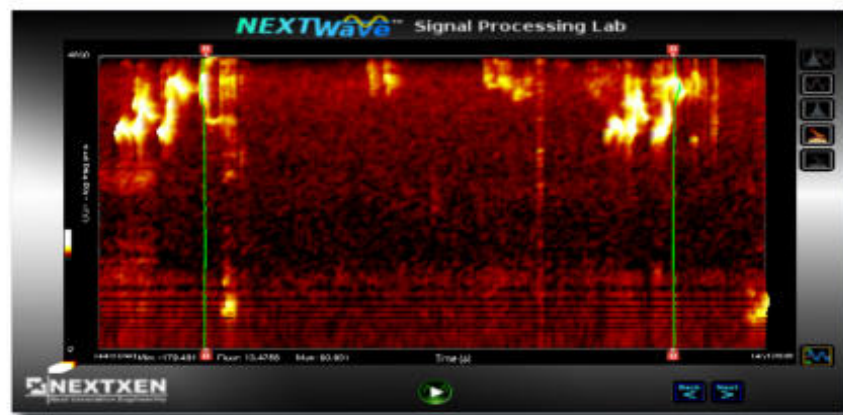
Vertical Lock control will cause all waveforms to be coupled together so that the positioning of one waveform in the Y-axis will cause all waveforms to track on the same scale.

## Horizontal Lock

Horizontal Lock control will cause all waveforms to be coupled together so that the positioning of one waveform in the X-axis will cause all waveforms to track on the same time scale.

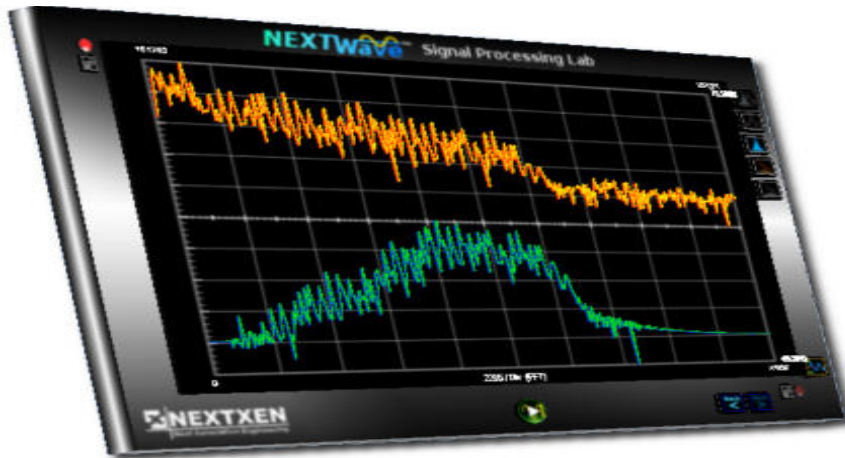
## Waveform Ribbon Height

The waveform ribbon height can be user-adjusted to enhance data analysis when displaying waveforms.



3D Rotation Effect

# Frequency Domain Transforms



Frequency Analysis of a Signal

## Frequency Transform Options

Due to the importance placed on frequency domain analysis, there are several methods of calculating the frequency content of an input signal when viewing data in the frequency display modes. These allow for flexibility in analyzing signals and include the traditional Fast Fourier Transform (FFT), the Constant-Q Transform (CQT), and a Frequency Band Transform.

### Fast Fourier Transform

One of the most common frequency domain analysis tools is the FFT algorithm. When this option is selected the FFT is used to map time-domain data to its frequency-domain counterpart. The Viewpad display will show frequency content on a linear frequency domain scale. Magnitude can be displayed either linearly or logarithmically.

### Constant Q Transform

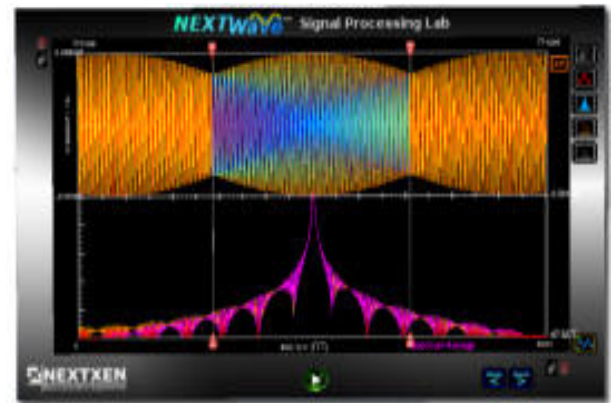
When this option is selected the CQT algorithm is used to map time-domain data to its frequency-domain counterpart. The Viewpad display will show frequency content on a logarithmic scale. The CQT does provide some advantages over the FFT method for some data analysis applications, although it is often slower than the FFT. It is well-suited to working with speech and musical waveforms. The CQT yields a magnitude versus log frequency output where fewer frequency bins are needed to effectively cover a desired range. This may prove useful in cases where frequencies range to several octaves. The log scaling attempts to mirror the human auditory system where spectral resolution at lower frequencies is better. Magnitude can be displayed either linearly or logarithmically.

### Frequency Band Transform

Another option that may be selected for frequency domain analysis is the Frequency Band Transform algorithm. This is a very useful in that it allows the user to choose the starting frequency of interest, the ending frequency of interest, and the frequency step between them; it provides for direct control over the resolution in the frequency domain. The Viewpad display will show frequency content on a linear scale, but within the user-specified frequency range. Magnitude can be displayed either linearly or logarithmically.

### Choices for Region-Of-Interest Selection

NEXTWave SPL allows for a number of different ways to select the time domain region used by the selected frequency domain transform. The transform input size may be independent of the transform size, so zero-filling and truncation are possible. The region can be specified by transform size, input framesize, displayed data, marker pairs, or a user-specified custom size. Indicators on the Viewpad show when conditions such as zero-filling or truncation occur.



Selecting the Region-Of-Interest with a Marker

### Other Selectable Options

Other user-selectable frequency transform options include setting a 0dB reference point, window-type, spectrum averaging with selectable weighting and freeze/reset control, and spectrogram overlap and display width options.

# Processing Capabilities



Design Waveform Menu Ribbon

## Adding User-Defined Custom Functions

NEXTWave SPL provides an open software architecture that allows the user to easily add their own custom functions for use in the Design Waveform programming interface.

Sample source code templates on which to base customized user-defined functions are provided.

## Design Waveform Programming Interface

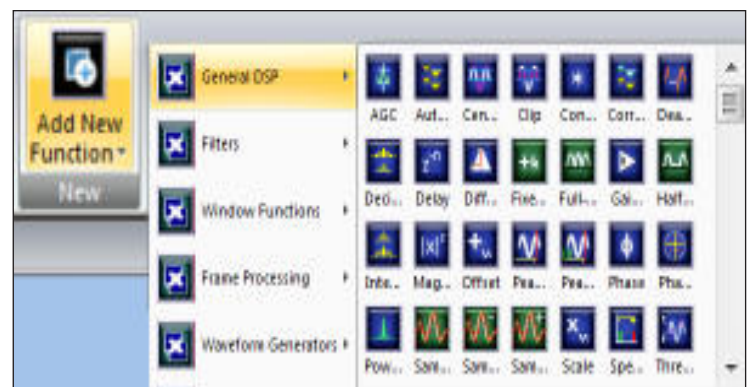
NEXTWave SPL provides the flexible Design Waveform programming interface to allow users to process a data stream before it is displayed on the Viewpad. Programming is achieved graphically through the manual selection and use of preexisting signal processing and analysis functions that are placed into an ordered sequence. These functions operate on file-based data, processed data, and continuously acquired real-time data. The Design Waveform interface is based upon a standard menu ribbon that provides an intuitive means of constructing algorithms. The entire algorithm and data flow can easily be seen on the menu ribbon.

## Powerful Signal Processing Algorithms

NEXTWave SPL contains a variety of signal processing and analysis algorithms that have each been packaged for easy use. These algorithms are designed to work together to produce a desired outcome on an input data stream for subsequent data analysis via the Viewpad display.

Many of the signal processing and analysis functions contain their own set of algorithm parameters that are user-governed. For example, the amplitude of a Sine Waveform Generator function is user-selected to achieve a desired result. By modifying these function parameters the user changes the overall processing which occurs when the program executes. These parameters may also be changed by slider controls.

Each function is represented by a unique graphical icon. Configuring a function is achieved by first selecting the icon via a mouse click which exposes that function's configuration panel. Individual algorithm parameters that are user-adjustable are then shown. By using the mouse and keyboard the user is able to alter any function parameters that have been exposed.



Function Selection

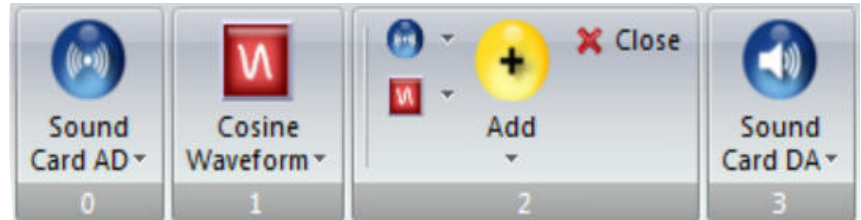
# Processing Capabilities

## Apply DSP Easily

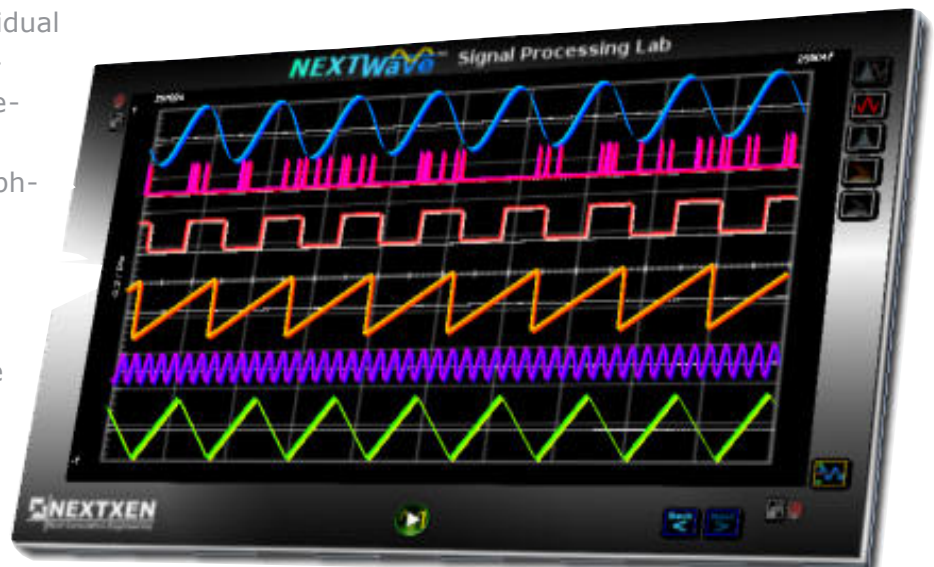
Users need not be experienced programmers to use NEXTWave SPL's powerful programming capability. An algorithm is created by simply selecting from a menu of functions in a desired sequence. Individual functions that operate on waveform data are represented by icons and are grouped together in a related fashion. These functions each operate on an input data stream to produce a processed output data stream. Individual parameters for functions can be user-adjusted 'on-the-fly' to alter the implementation of the programmed algorithm. No textual source code or graphical block diagrams are required.

## On-the-Fly Adjustment

Individual parameters for a function can be changed dynamically while the algorithm is being executed. The immediate result of these changes is displayed 'live' while running, thus allowing quick feedback in analysis and design.



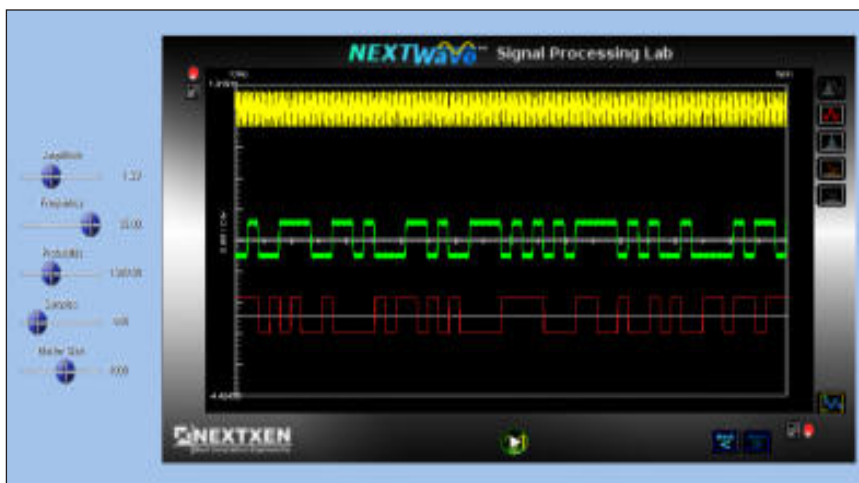
Program via Graphical Representations



Working with Multiple Channels of Data

## Multiple Channels of Data

NEXTWave SPL allows multiple data channels to be processed and analyzed. Up to eight channels of data may be displayed at one time. In addition to standard time domain signals being displayed, simultaneous frequency domain displays are also supported for each of the time domain signals. An optional 'Horizontal Lock' is available to keep channels in sync if desired.



On-the-fly Parameter Control

# Real-time Acquisition

## Support for Standard Acquisition Hardware

NEXTWave SPL software provides the ability to perform real-time data acquisition and generation through the support of standard Sound Card hardware, as well as other third-party data acquisition hardware.

## Acquiring Data from the A/D

NEXTWave SPL includes analog I/O functions that can be used to acquire real-world data. The Sound Card A/D function allows data to be acquired as an input waveform via the input channels of a standard Windows-compatible sound card. It allows for the specification of input channel, sample rate, adjustable gain, and number of samples per frame to be acquired. Support for other third-party data acquisition hardware is also available.



Acquired A/D Input displayed as a Spectrogram



Example of sending data to D/A

## Sending Data to the D/A

A unique feature provided in NEXTWave SPL is the ability for the user to select and send a section of a waveform displayed in the Viewpad to the Sound Card D/A. Both the Time and Spectrogram Viewpad display modes allow for means of selecting sections of waveform data and sending them directly to the Sound Card D/A to allow for a 'see-it/hear-it' experience.

### Straightforward Operation

Using NEXTWave SPL to work with real-world signals is easy - simply add an analog I/O function to the Design Waveform menu ribbon and you are ready to start working with your data.

1. Add an A/D function to the Design Waveform menu ribbon
2. Select the A/D function icon to configure its parameters; select a desired sample rate and input channel
3. Press the Run button
4. Use NEXTWave SPL to display the data as a time-domain, frequency-domain, or spectrogram display.

Add additional signal processing functions, such as filtering, to the Design Waveform menu ribbon to process and view the data as it is acquired.

# Functions

## Plenty of Functions Included

NEXTWave SPL includes many powerful signal processing functions to allow you to create and modify your data without having to write source code. And since the SPL environment makes it easy to combine functions there are virtually countless ways to process and analyze your signals.

## Add Your Own

Of course, if you need a special function, perhaps even a proprietary one, it is simple to add a new one using a standard C compiler. Each NEXTWave SPL function is a standard DLL. Source code templates are included to get you started quickly.

## Partial List of Functions

### Analog I/O

- Sound Card A/D
- Sound Card D/A

### Arithmetic Operators

- Absolute Value
- Addition
- Complex to Imaginary
- Complex to Real
- Division
- Logarithm
- Natural Logarithm
- Multiplication
- Raise-to-Power
- Product
- Real:Imaginary to Complex
- Real to Complex
- Reciprocal
- Sign
- Square
- Square Root
- Subtraction
- Summation

### Communication

- Automatic Gain Control (AGC)
- Fixed-Offset
- Full-Wave Rectify
- Half-Wave Rectify

### Digital Filtering

- Bandpass Filter
- Biquad
- First-Order Butterworth
- LMS Adaptive Filter
- Notch Filter
- Butterworth IIR Filter
- Chebyshev I IIR Filter
- Chebyshev II IIR Filter
- Elliptic IIR Filter
- Kaiser Window FIR Filter

### General DSP

- Autocorrelation
- Center Clip
- Clip
- Convolution
- Correlation
- Dead Band
- Decimate
- Delay
- Differentiate
- Fixed-Offset
- Full-Wave Rectify
- Gain Stage
- Half-Wave Rectify
- Interpolate
- Magnitude
- Offset
- Peak Position
- Peak Magnitude
- Phase
- Phase Decoder
- Power Spectrum
- Scale
- Sample and Hold
- Sample and Hold, Negative
- Sample and Hold, Positive
- Spectral Inversion
- Threshold

### Speech Functions

- ADPCM Decode
- ADPCM Encode
- Linear Predictive Coding
- Pitch Tracker

### Statistical

- Polynomial Curve Fit
- Root Mean Square
- Zero Crossings

### Transforms

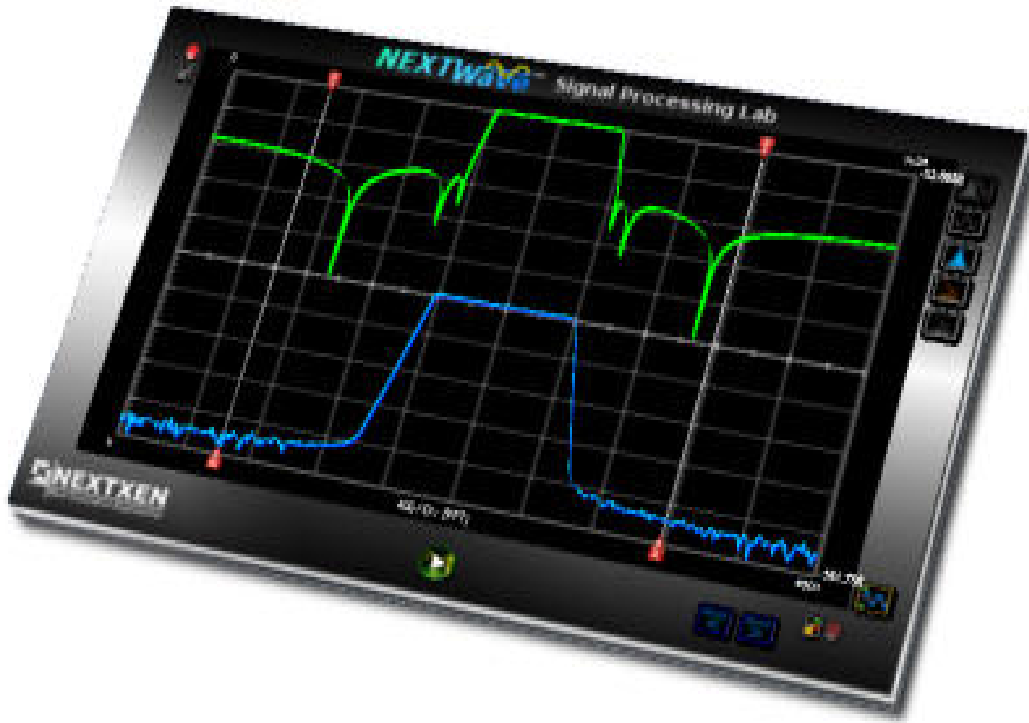
- FFT
- FHT
- Frequency Zoom
- Goertzel Transform
- Hilbert Transform
- Inverse FFT
- Inverse FHT

### Window Functions

- Bartlett
- Blackman
- Gaussian
- Hamming
- Hanning
- Kaiser
- Welch

### Waveform Generators

- Complex Exponential
- Constant Generator
- Cosine Waveform
- Gaussian Noise
- Impulse Generator
- Impulsive Noise
- Noise Generator
- PRN Generator
- Pulse Train
- Ramp
- Sawtooth Waveform
- Sine Generator
- Square Waveform
- Sweep Generator
- Triangle Waveform



Digital Filtering with NEXTWave SPL

## Useful for many Signal Processing Applications

NEXTWave SPL provides a signal processing and analysis environment rich in waveform display options and data manipulation capabilities. It can be used in a variety of signal processing and data analysis applications.

### DSP Expertise at Your Fingertips

NEXTWave SPL has been designed by DSP engineering professionals with over 50 man-years experience in DSP software. Let NEXTWave SPL give you the advantage of advanced signal insight for your application.

#### How to Order

Order online, call, or email/fax a Purchase Order.

NOTE: Academic institutions may qualify for a discounted price on software

#### More Information

Document NXMK9000, NEXTWave SPL Overview

Visit us on the web and find out more about NEXTWave SPL.



#### Acquire & Create Signals

A standard PC-based sound card and supported third-party data acquisition hardware can be used to acquire a real-world signal directly into the NEXTWave SPL environment.

#### Work in the Time Domain

Data can be analyzed and processed in the time domain where it is displayed against an amplitude versus time interactive 2D graphical display, with full 3D rotation.

#### Work in the Frequency Domain

Data can be analyzed and processed in the frequency domain where it is displayed against a magnitude versus frequency interactive 2D graphical display, with full 3D rotation.

#### Benefit from Enhanced Spectrogram Analysis

Data can be viewed in a spectrogram representation where it is displayed in a magnitude versus time versus frequency interactive 3D graphical display, with full 3D rotation.

#### Generate Signals

Make your signals come to life. For acoustic applications, a standard PC-based sound card can even be used to generate real-world signals from the NEXTWave SPL environment.

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