C H A P T E R 13

LabVIEW DSP Module

The LabVIEW DSP Module is a newly released tool by NI which allows one to run graphical codes on a number of DSP target platforms without resorting to text-based programming. The modularity and reusability features of this tool facilitate modifications or extensions of DSP graphical codes. As a result, the process of prototyping DSP systems becomes more time efficient when using this tool.

The LabVIEW DSP Module provides an interactive GUI for designing and debugging a real-time embedded DSP application. For example, while an object code is running on the DSP processor, one can change its input via a front panel, update front panel controls/indicators, and monitor the resulting output from the DSP on a host PC.

This module also permits easy interfacing with the i/o peripherals on the DSP target boards including audio codecs, dip switches, and LEDs. In other words, it bypasses the need for bit-level configuration of registers. Furthermore, the process of setting up the configuration of the linker command file for memory configuration and the interrupt service routine for data i/o is eased by simply locating the supplied functions as part of this module.

Currently, the LabVIEW DSP Module supports the following DSP target boards: Spectrum Digital C6711 DSK, C6713 DSK, and National Instrument SPEEDY-33. The code on a specific platform can be switched to another platform with ease as the peripherals get automatically replaced.

13.1   Installation of LabVIEW DSP Module

To install the LabVIEW DSP Module, one can choose Install the LabVIEW DSP Module for NI-SPEEDY and TI DSKs from the autorun dialog or run setup.exe file as part of this module CD. The software to be installed include the following items; LabVIEW DSP Module, LabVIEW 7.1 Embedded Edition, DSP support files and drivers. These items get installed into the folder `C:\Program Files\National Instruments\LabVIEW 7.1 Embedded`, which is different than the original LabVIEW folder, i.e. `C:\Program Files\National Instruments\LabVIEW 7.1`.   For additional details on the installation, refer to [1].

13.2   Functions & VIs

The VIs included in the LabVIEW DSP Module fall into the following categories: Elemental I/O Nodes, Filter VIs, Transform VIs, Window VIs, Time Domain VIs, Embedded Signal Generation VIs, and Frequency VIs. These VIs are widely used in various DSP applications such as communication, modulation and demodulation, FIR/IIR filtering, LMS (least-mean-square) filtering, speech processing/analysis, noise analysis, and cross correlation [2].

Each function or subVI of the LabVIEW DSP Module corresponds to the pre-compiled object file of a hand-optimized code, thus providing a maximum throughput. The data types allowed are integer, floating point, Boolean, and array. The dynamic data type is not supported by this module.

13.3   LabVIEW DSP Module Example: Heterodyne.vi

In this section, a simple example is presented to show the basic steps one needs to take when using the LabVIEW DSP Module. From the main dialog of the LabVIEW Embedded Edition, an execution target should be chosen, for example DSK6713 as shown in Figure 13-1. The NI Example Finder, illustrated in Figure 13-2, can be opened by choosing Help » Find Examples. Let us consider the example `Heterodyne` VI. This VI can be opened by clicking on Directory Structure from the category Browse according to of the Browse tab, and then by choosing EmbeddedDSP » Heterodyne.vi.
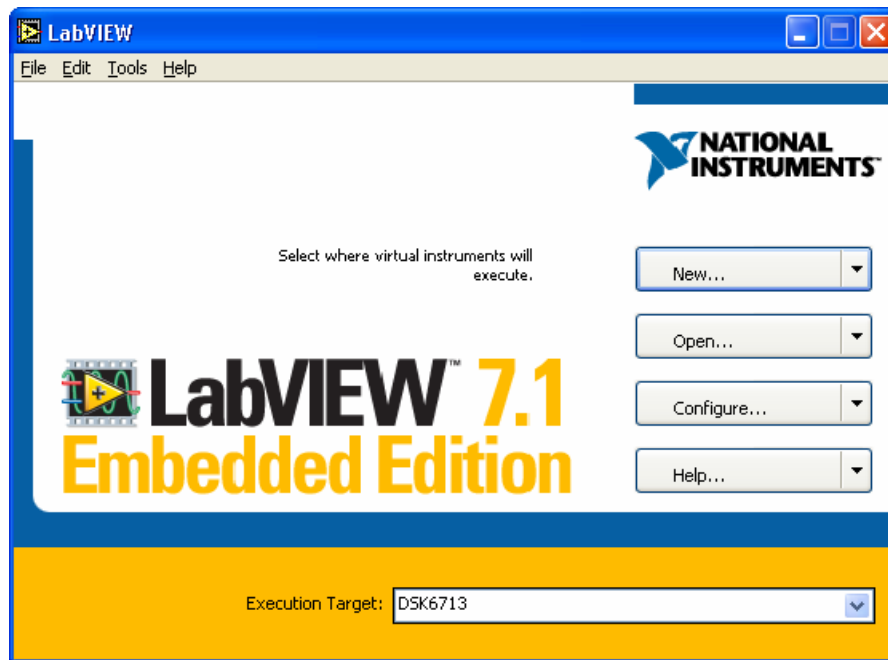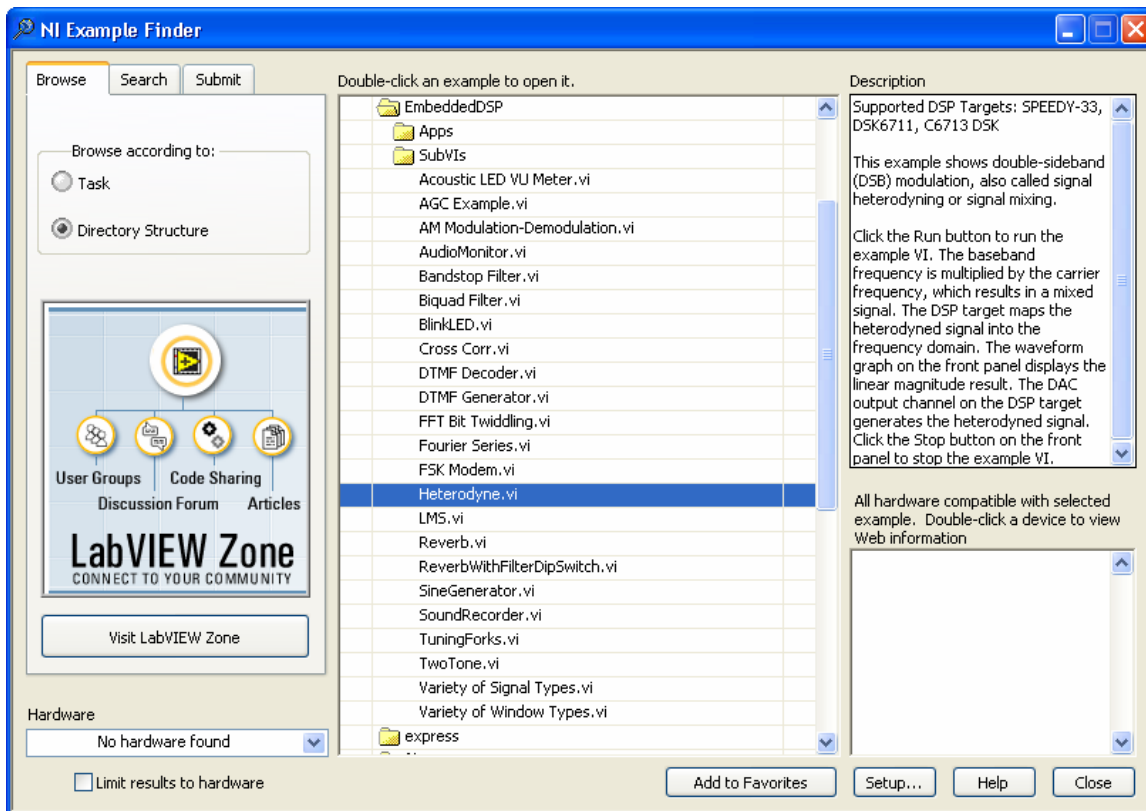
Figure 13-1: LabVIEW Embedded Edition.

Figure 13-2: NI Example Finder - Heterodyne example.

In this example, a baseband signal is modulated by a carrier signal and sent to the audio codec of a DSP target board. The spectral analysis of the modulated signal is also carried out on the DSP and the spectrum is displayed in a Waveform Graph on the host PC. The frequencies of the baseband and carrier signals can be altered by the controls specified in the FP as shown in Figure 13-3. The BD of the LabVIEW DSP VI is the same as that when using LabVIEW with two exceptions: First, the output datatype of the Express VIs are not dynamic. Second, to send output samples to the audio codec, the `Analog Out` node, labeled as Codec Out, needs to be used.
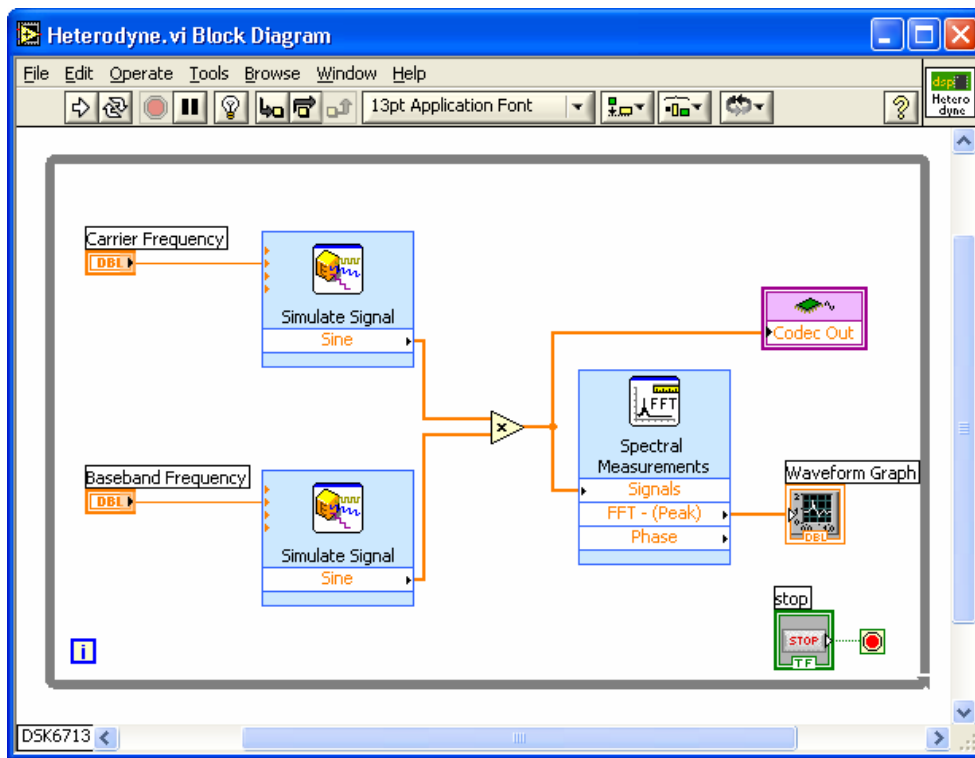
(a)
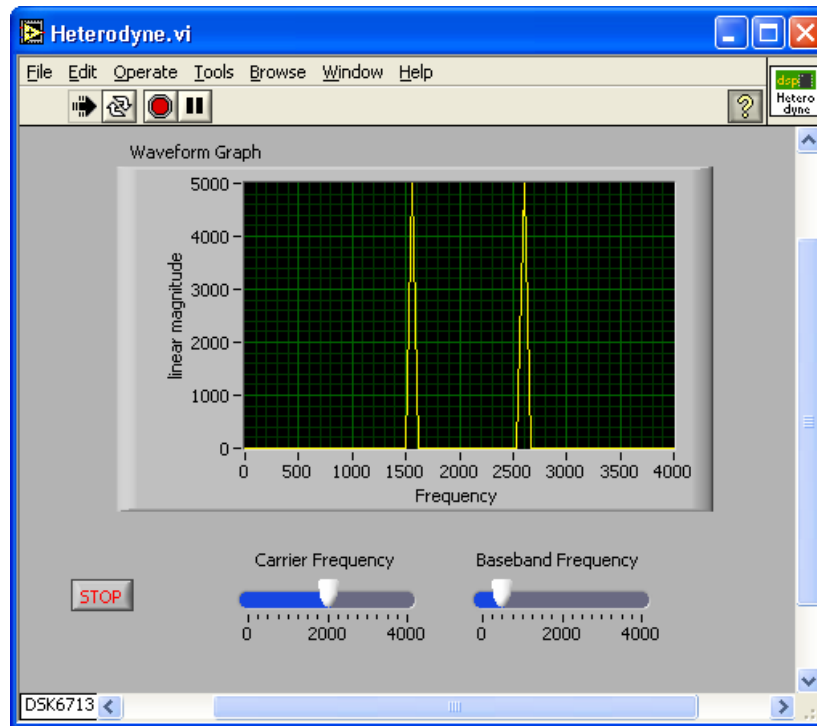
(b)
Figure 13-3: Heterodyne example: (a) BD (b) FP.

To provide further familiarity with the LabVIEW DSP Module, in the lab that follows, three DSP system examples covered in the previous chapters are redone based on this module.

13.4 Bibliography

[1]   National Instruments, *LabVIEW DSP Module Release Notes*, Literature Number 371298A-01, 2005.

[2]   National Instruments, *Getting Started with the LabVIEW DSP Module*, Literature Number 371297A-01, 2005.