SMT6050

User Manual

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Revision History

Date	Comments	Engineer	Version
4-20-2005	Initial Release	R.N	1.0

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Chapter 1

Introduction

SMT6050 is the Matlab® and Simulink® toolbox for all of Sundance's hardware. It provides the customer with the flexibility of working in the Simulink® environment. This will speed up the development time of many systems since there is no code needed for the Sundance hardware.

Simulink

Simulink® is a simulation and prototyping development tool for modeling, simulating, and implementing real-world dynamic systems. Data acquisition, environment control and processing power provided by Sundance products as the front-end of any system is complemented by Simulink® to build, easy to develop and maintain, target applications. User interface is in a form of block diagrams that are intuitive and easy to understand. Building of blocks and interconnections between them defines a data flow, type of processing and in final stage the customer's algorithm and system. This technology generates optimized C code for your application and compiles it into a binary format for further downloading to the Sundance products. Code Composer Studio provides a complete project management environment.

Chapter 2

Supported Hardware

SMT335
SMT335E-1000
SMT335E-2000
SMT361
SMT365
SMT365E
SMT365G
SMT374-6713-2
SMT375
SMT375E-1000
SMT375E-2000
SMT376-6711-128
SMT376-6711-256
SMT395-VP20-5
SMT395-VP30-6

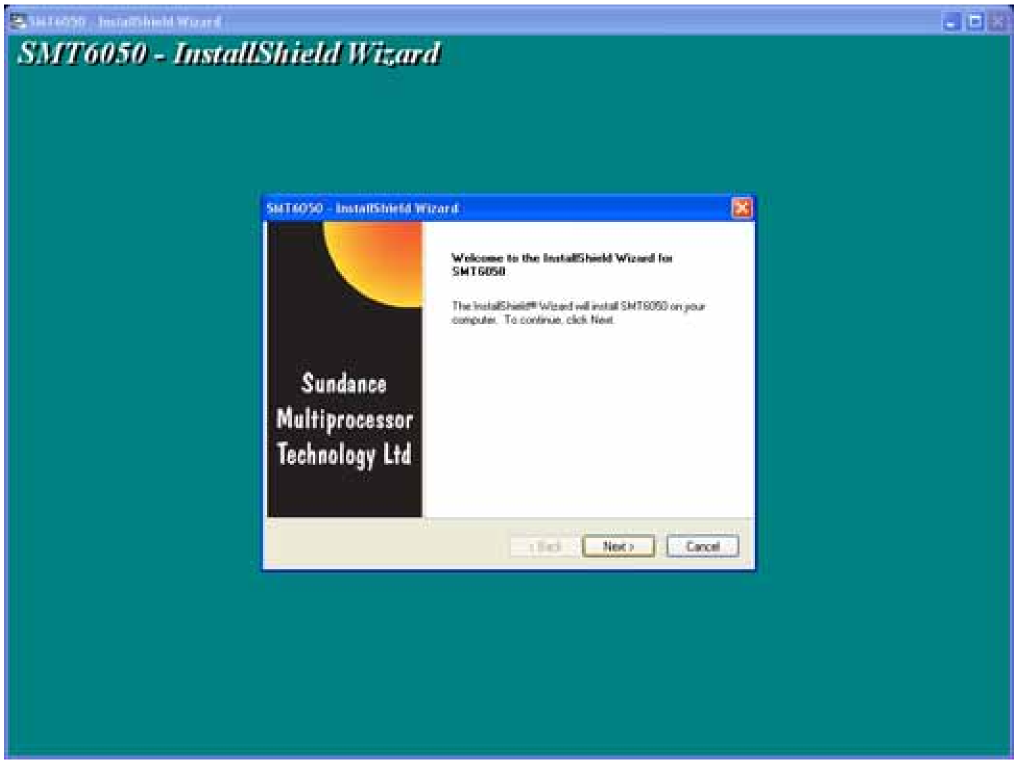
Software Requirements

Software	Processors	Disk Space	RAM
Matlab v14/14.1 Simulink RTW	Pentium III, IV, Xeon, Pentium M, AMD Athlon, Athlon XP, Athlon MP	400MB	256MBMin 512MB (Recommended)
CCS 2.2 (3.0)	233MHz or higher	630MB	256MB
SMT6050	233MHz or higher	20.5MB	128MB

Chapter 3

Installation

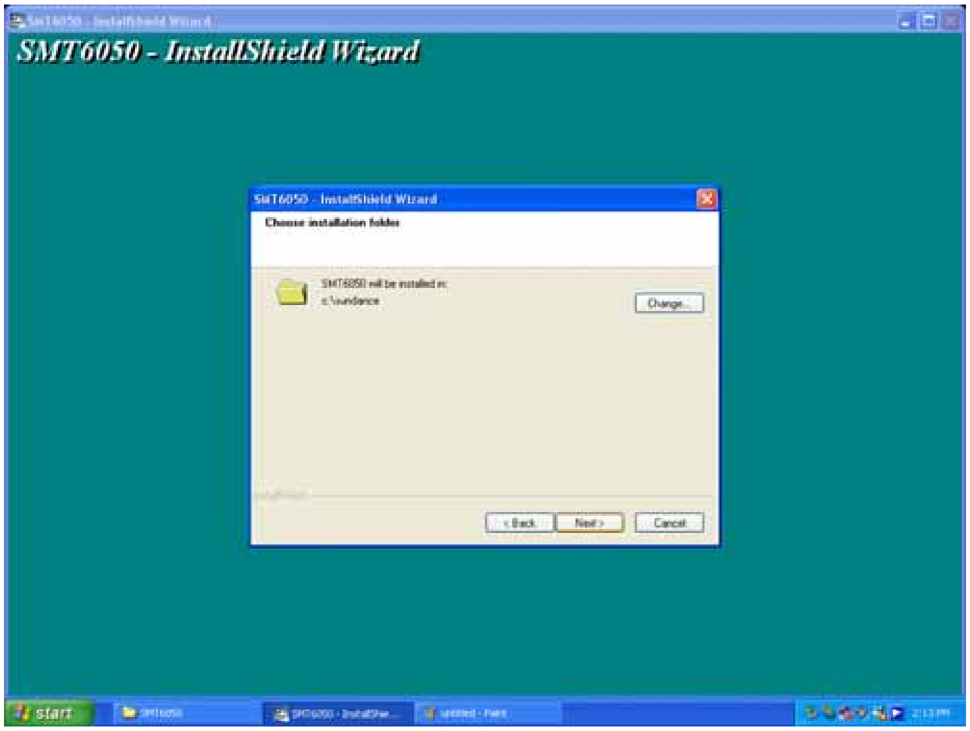
****
When installing SMT6050 please don't install to any folder with spaces. Therefore the user should not install to the 'Program Files' folder. The same thing goes with Code Composer studio. Matlab has trouble dealing with spaces.
****


SMT6050 - InstallShield Wizard
SMT6050 - InstallShield Wizard
SMT6050 - InstallShield Wizard
Sundance Multiprocessor Technology Ltd
< Back
Next >
Cancel

Welcome to the InstallShield Wizard for SMT6050

The InstallShield® Wizard will install SMT6050 on your computer. To continue, click Next.

Figure 1: First page


SMT6050 - InstallShield Wizard
SMT6050 - InstallShield Wizard
start

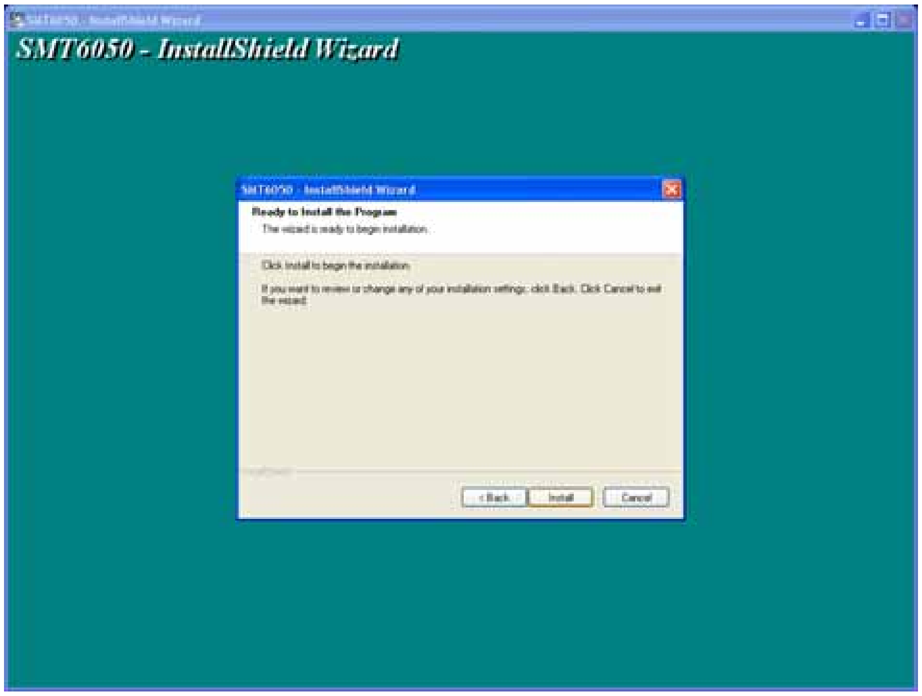
Choose installation folder

SMT6050 will be installed in:
c:\sundance

Change...
< Back
Next >
Cancel

Figure 2: Location of installation

When selecting a directory to install the SMT6050, make sure that it is not to a folder with any spaces in the name. This will cause it not to work.


SMT6050 - InstallShield Wizard
SMT6050 - InstallShield Wizard

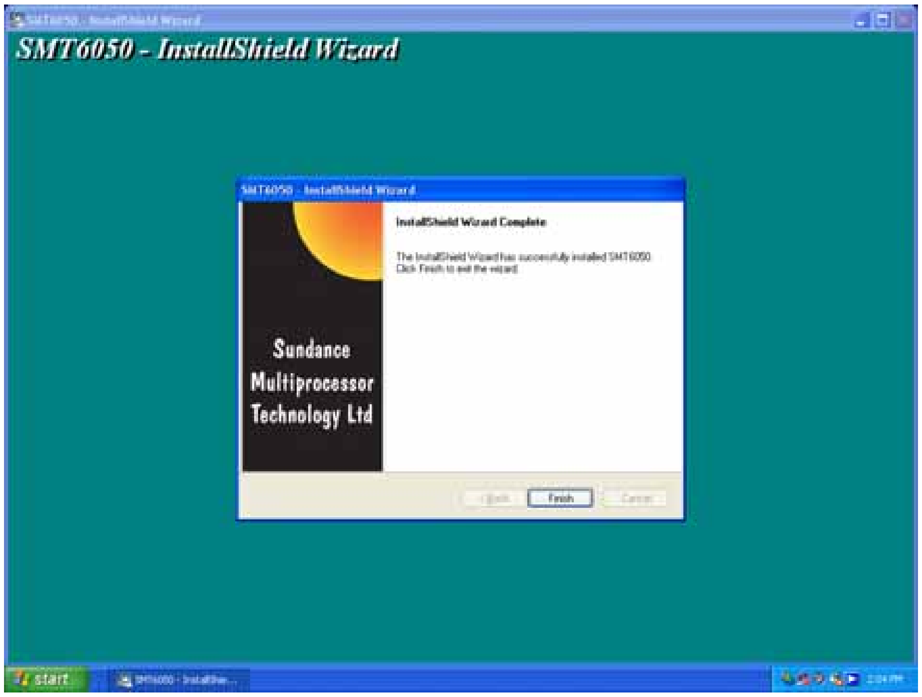
Ready to Install the Program

The wizard is ready to begin installation.

Click Install to begin the installation.

If you want to review or change any of your installation settings, click Back. Click Cancel to exit the wizard.

Figure 3: Ready to install section


SMT6050 - InstallShield Wizard
SMT6050 - InstallShield Wizard
Sundance Multiprocessor Technology Ltd
< Back
Finish
Cancel
start

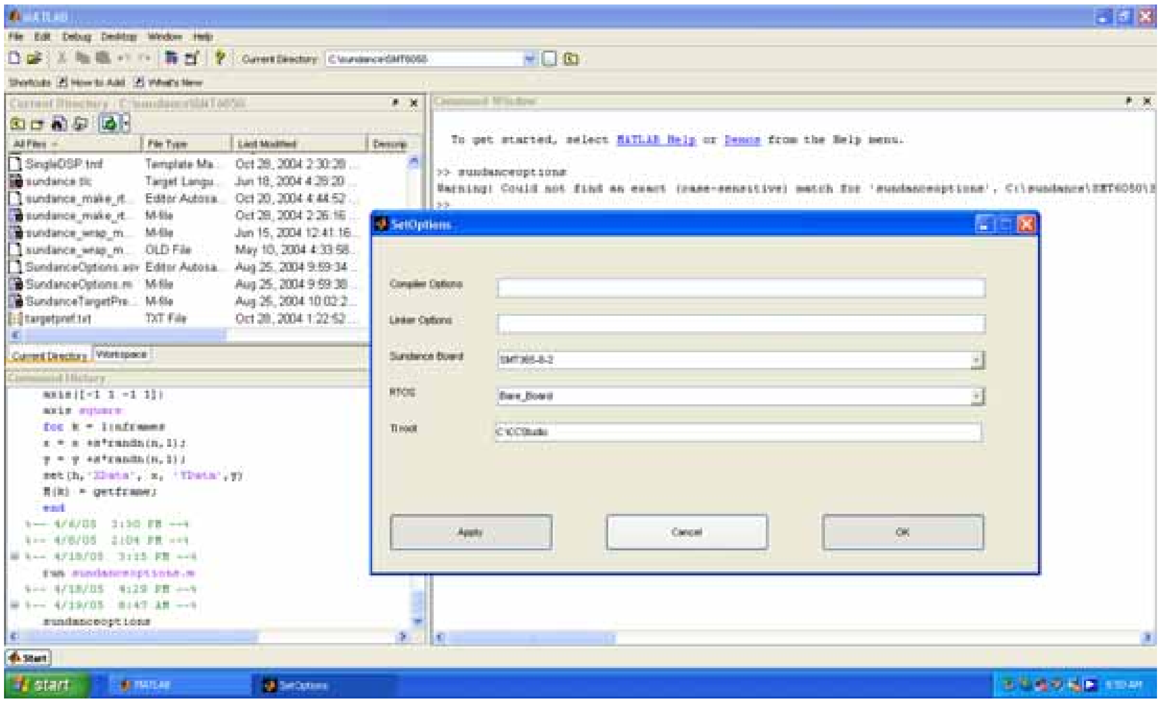
InstallShield Wizard Complete

The InstallShield Wizard has successfully installed SMT6050. Click Finish to exit the wizard.

Figure 4: Installation complete

Configuration

In the command window type SundanceOptions and the following screen will appear. This will allow the user to set up the SMT6050.



```
  To get started, select MATLAB Help or Demos from the Help menu.

>> sundanceoptions
Warning: Could not find an exact (case-sensitive) match for 'sundanceoptions', C:\sundance\SMT6050\
>>
```

Compiler Options	
Linker Options	
Sundance Board	SMT365-8-2
RTOS	Bare_Board
TI root	C:\CCStudio

Figure 5: Configuration window

Compiler options:	These are compiler options, which will be passed to C6X during compilation. For more information please consult Code Composer Studio documentation.
Linker Options:	These options will pass to the linker during linkage phase. For more information please consult Code Composer Studio documentation.
Sundance Board:	This section allows the user to select which board is being used so therefore which type of DSP the code is being written for.
RTOS:	At the moment the only option available is for Bare Board systems.
TI root:	The user must specify the directory of the TI Code Composer studio root folder in this section.

The SMT6050 is now installed and fully configured.

Chapter 4

Related Documents

Matlab Release 14.2 Data Sheet

Simulink Version 6.0 Data Sheet

Real Time Workshop (v5)

Code Composer Studio User Guide

SMT6012 Manual

SMT6025 Manual

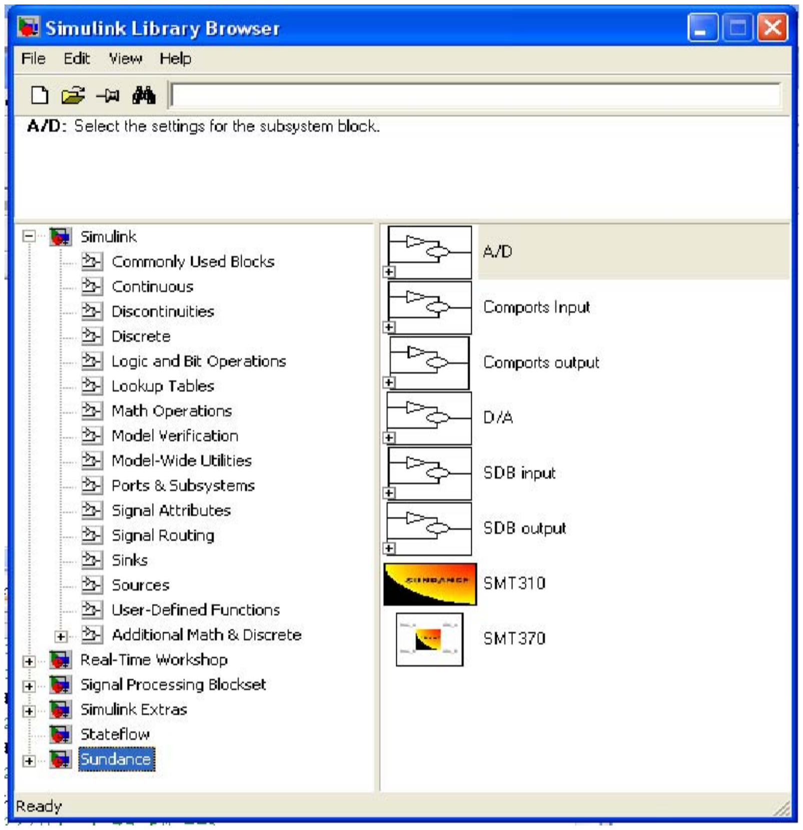
Support

Please register on the Sundance Support Forum if not yet registered. Then enter your company's forum and request the support you need for the desired product. You may also contact us at support@sundance.com.

To reach us by telephone you can call +1(775) 827-3103 for Sundance DSP, or +44 (0)1494 793167 for Sundance Multiprocessor, or +39 0185 385193 for Sundance Italia.

Library

SMT6050 provides all the blocks needed for creating code that runs on any of the Sundance DSPs. To see the library within SMT6050 the user must type ‘Simulink’ in the command window. The following screen will open:



A/D: Select the settings for the subsystem block.

Figure 1 Library

With these different blocks the user can design a system, which can be easily debugged due to the graphical interface of Simulink®.

Chapter 5

Demos

SMT6050 comes with four demos' to help illustrate the process of designing a system and how the final C code is generated.

These demos run on an SMT365, SMT370 and an SMT310Q.

The connections are as follows:

1. FMS between T1C0 and T2C3
2. Connect SHB A on SMT365 to SHB A on SMT370 via SMT516 or SHB Cable
3. Connect SHB B on SMT365 to SHB B on SMT370 via SHB Cable
4. Connect J10 to J12 and J9 to J13 on the SMT370

There are 3 demos for 3 types of applications:

1- Data acquisition and processing. In this demo, SMT 370 is used to generate a pattern with DAC and then capture it with ADC. The FFT of a captured signal is then calculated and sent to the PC to display in real time. Only one ADC channel is used for this purpose since the other channel is the same.

2- DSP coprocessor. In this demo, the DSP board is used as a DSP coprocessor for Matlab. Applications in Matlab send data to DSP board for fast processing. In the demo, a signal is generated in Matlab and sent to the DSP. In the DSP the FFT of this signal is calculated and returned back to Matlab. Matlab shows the signal and its FFT.

3- Hardware in the Loop. In this application, some sections of the simulation are done in the PC and some other section is done in DSP. In this demo, a Microphone and PC speaker is used for signal capturing and DSP processes them.

All of the demos are saved under the Demo subdirectory.

C:\Sundance\demos

Data acquisition Demo:

This demo is under 370_realtime subdirectory.

There are 3 files there:

1- Demo370dsp.mdl: Simulink model for code generation.

2- Demo370.m: Matlab code for displaying captured data in real-time.

3- Demo370.fig: GUI for Matlab code.

Running the demo:

1- Start Matlab.
2- In the Matlab command window, change the directory to the 370_realtime directory.
   cd C:\ Sundance\demos\370_realtime
   Or at the top of the Matlab window there is a tab that says current directory. The directory can be changed there rather than typing the address each time.
3- Type open demo370dsp.mdl in Matlab command window. The following window should appear:

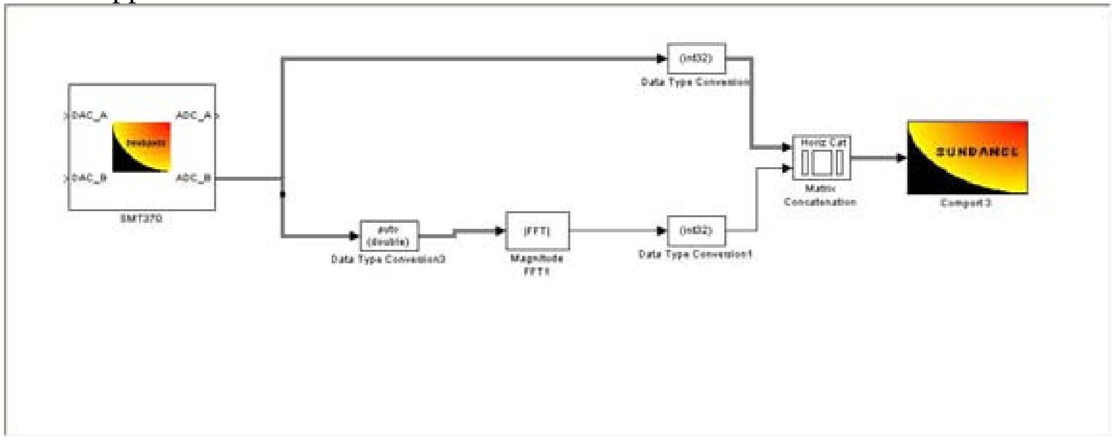
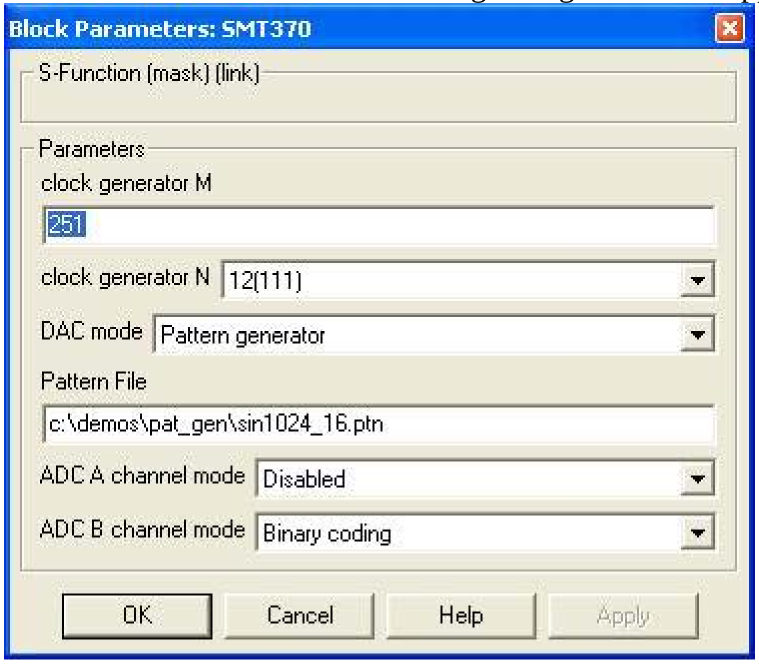


Figure 2 Matlab Window

4 - Double click on smt370. The following dialogue box will appear.

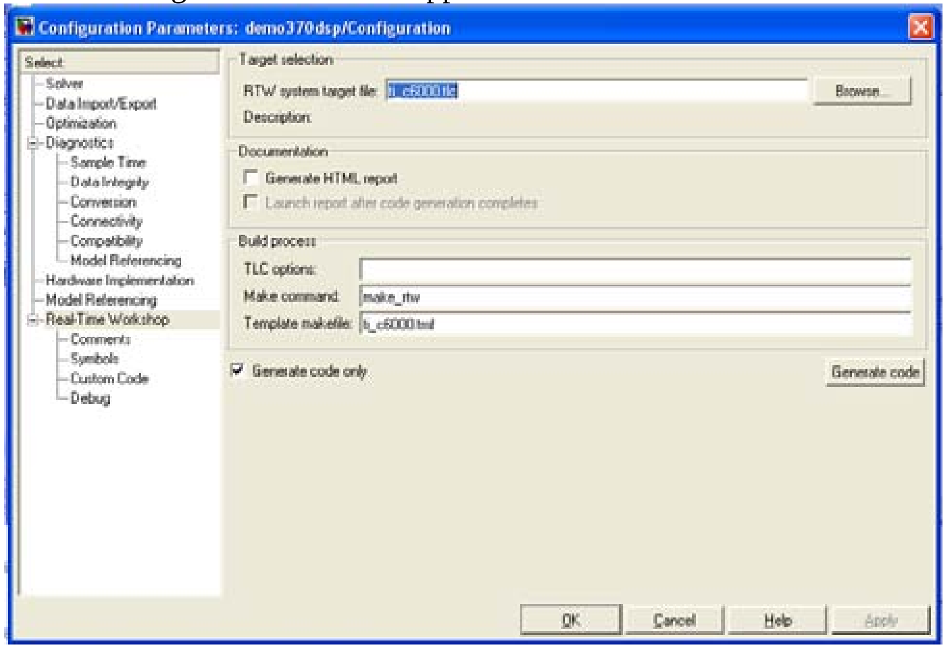


clock generator M: 251
clock generator N: 12(111)
DAC mode: Pattern generator
Pattern File: c:\demos\pat_gen\sin1024_16.ptn
ADC A channel mode: Disabled
ADC B channel mode: Binary coding

Figure 3 Parameters

4- Make sure that the path to pattern File is correct and pattern file is available.
5- From this window menu, select: Simulation-> configuration parameter

6- The following windows should appear:



Configuration Parameters: demo370dsp/Configuration

Select:
- Solver
- Data Import/Export
- Optimization
- Diagnostics
  - Sample Time
  - Data Integrity
  - Conversion
  - Connectivity
  - Compatibility
  - Model Referencing
- Hardware Implementation
- Model Referencing
- Real-Time Workshop
  - Comments
  - Symbols
  - Custom Code
  - Debug

Target selection
RTW system target file: ti_c6000.tlc
Description:

Documentation
☐ Generate HTML report
☐ Launch report after code generation completes

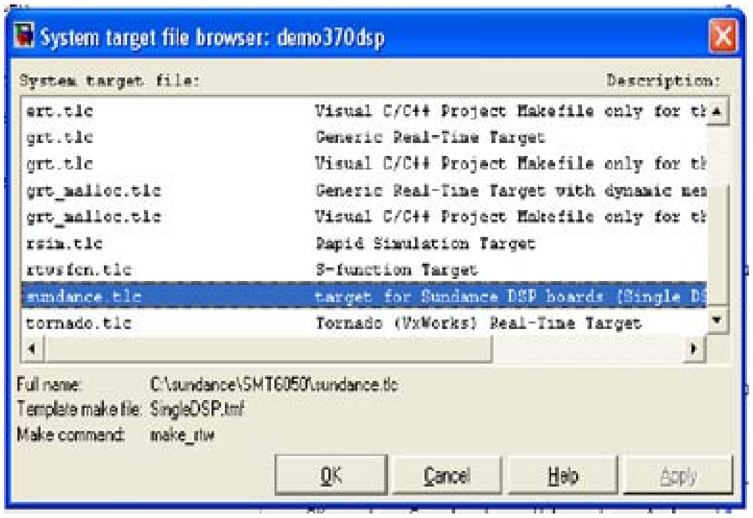
Build process
TLC options:
Make command: make_rtw
Template makefile: ti_c6000.tmf

☑ Generate code only

Figure 4 Build project

7- In the ‘RTW system target file’ select browse and then select ‘Sundance.tlc’ so that the code will be generated for Sundance hardware.

8- Press ‘Generate code’.



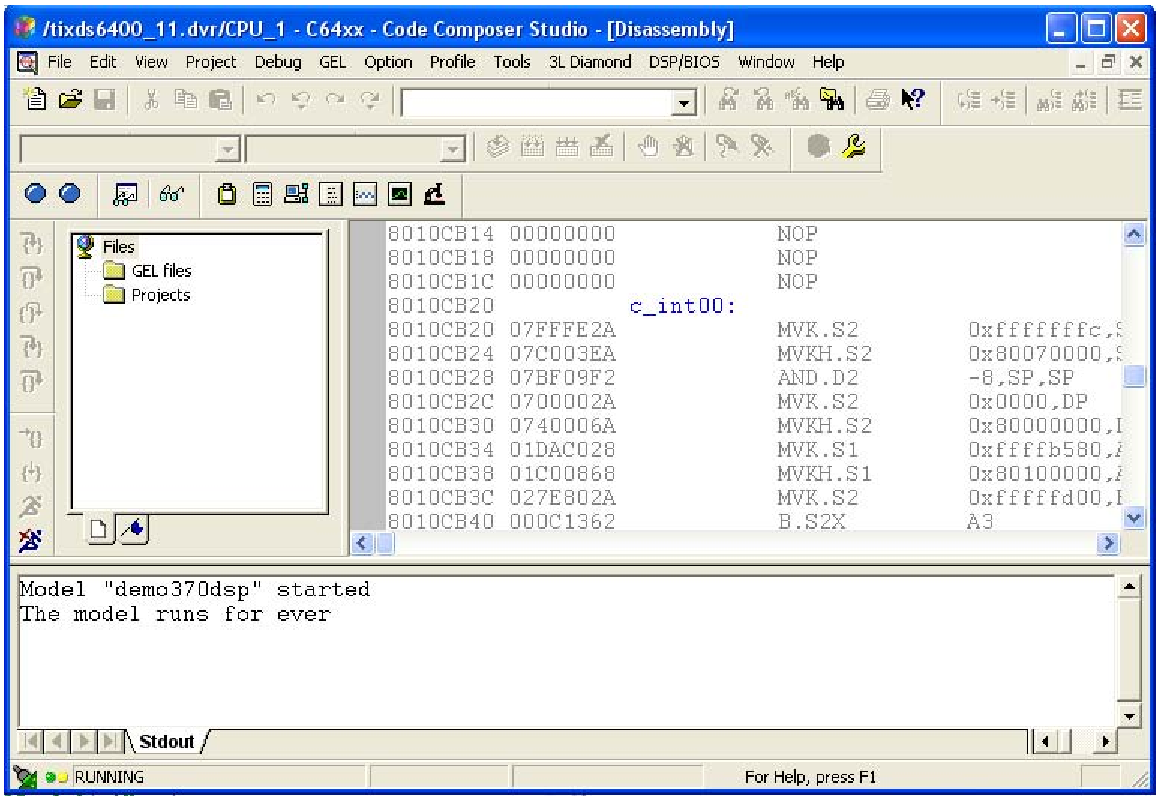
System target file browser: demo370dsp

```
System target file:                  Description:
ert.tlc                              Visual C/C++ Project Makefile only for th
grt.tlc                              Generic Real-Time Target
grt.tlc                              Visual C/C++ Project Makefile only for th
grt_malloc.tlc                       Generic Real-Time Target with dynamic mem
grt_malloc.tlc                       Visual C/C++ Project Makefile only for th
rsim.tlc                             Rapid Simulation Target
rtwsfcn.tlc                          S-function Target
sundance.tlc                         target for Sundance DSP boards (Single DS
tornado.tlc                          Tornado (VxWorks) Real-Time Target
```

Full name: C:\sundance\SMT6050\sundance.tlc
Template make file: SingleDSP.tmf
Make command: make_rtw

Figure 5 System Target File

9- After Matlab is done creating the code the user will have to start up Code Composer and add the created code.


/tixds6400_11.dvr/CPU_1 - C64xx - Code Composer Studio - [Disassembly]
File Edit View Project Debug GEL Option Profile Tools 3L Diamond DSP/BIOS Window Help
Files
GEL files
Projects
Stdout
RUNNING
For Help, press F1

```
8010CB14 00000000           NOP
8010CB18 00000000           NOP
8010CB1C 00000000           NOP
8010CB20          c_int00:
8010CB20 07FFFE2A           MVK.S2        0xfffffffc,S
8010CB24 07C003EA           MVKH.S2       0x80070000,S
8010CB28 07BF09F2           AND.D2        -8,SP,SP
8010CB2C 0700002A           MVK.S2        0x0000,DP
8010CB30 0740006A           MVKH.S2       0x80000000,I
8010CB34 01DAC028           MVK.S1        0xffffb580,A
8010CB38 01C00868           MVKH.S1       0x80100000,A
8010CB3C 027E802A           MVK.S2        0xffffd00,B
8010CB40 000C1362           B.S2X         A3
```

```
Model "demo370dsp" started
The model runs for ever
```

Figure 6 Code Composer Studio Window

10- Load the code into the DSP board File->load program
11- Run the program: Debug->Run
12- Make sure that the model is started by looking for the following message in CCS: “Model Started “
13- Select Matlab window and type: open 370demo.m
14- The following window should appear:

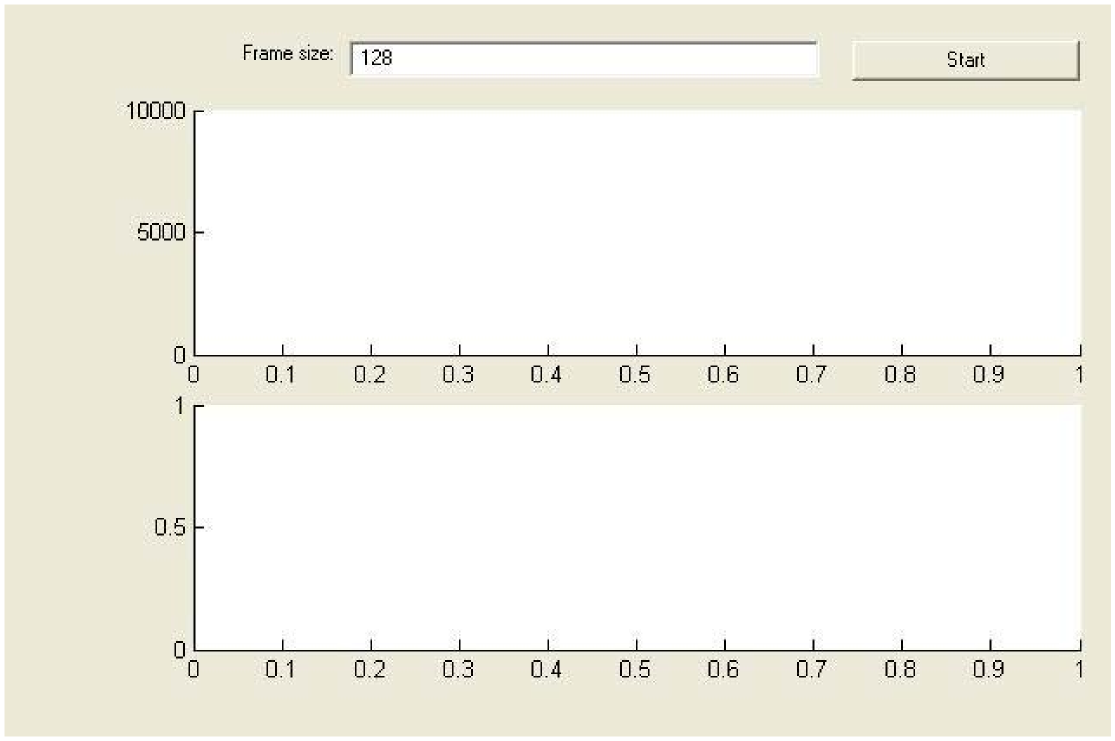


Figure 7 Real and FFT Graph

15- Don’t change Frame Size from 128! It is for further development!
16- Press start.
17- Real data should appear in the two graphs. The upper graph is the captured signal and the lower graph is its FFT.

18- The capturing stops after a little while. To start again, press Start.

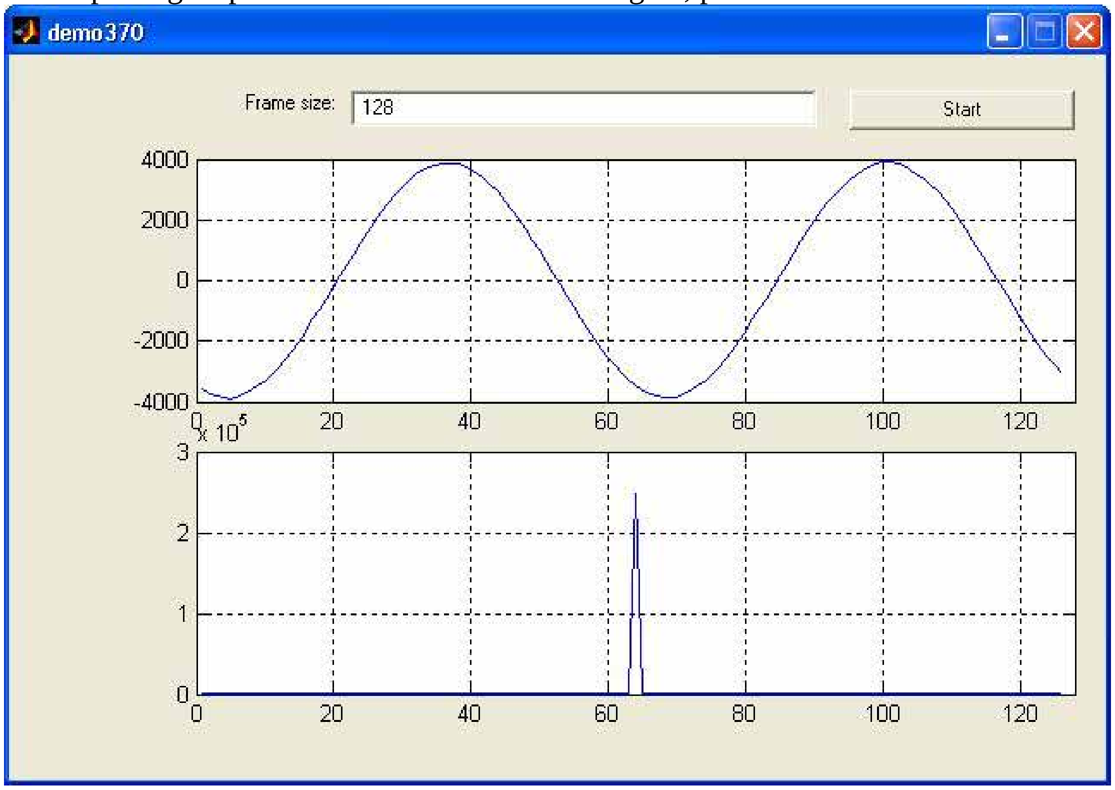


Figure 8 Real and FFT Graph

DSP coprocessor:

The object of DSP coprocessor is that the user sends time-consuming operations to DSP for fast processing. In this example, the DSP does FFT and sends the result back to Matlab.

There are 3 files in this demo:

1- DemoDSPcopDSP.mdl : the model for code generation.
2- DemoDSPcop.m Matlab program
3- DemoDSPcop.fig GUI for Matlab program.

Running the demo:

1- Run Matlab and change the Matlab directory to Dsp_cop.
2- Cd C:\ Sundance\demos\dsp_cop

3- Type in: Open demodspcopdsp.mdl

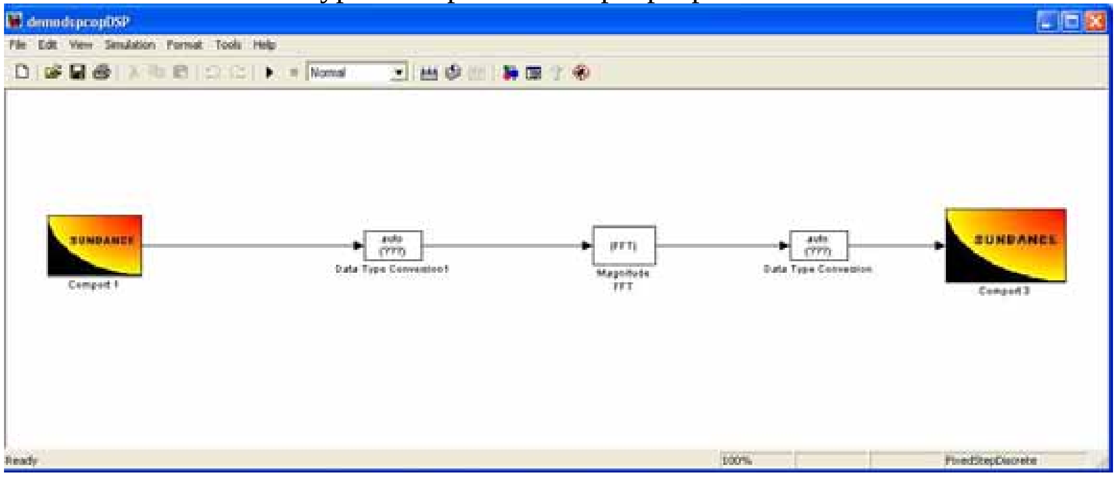
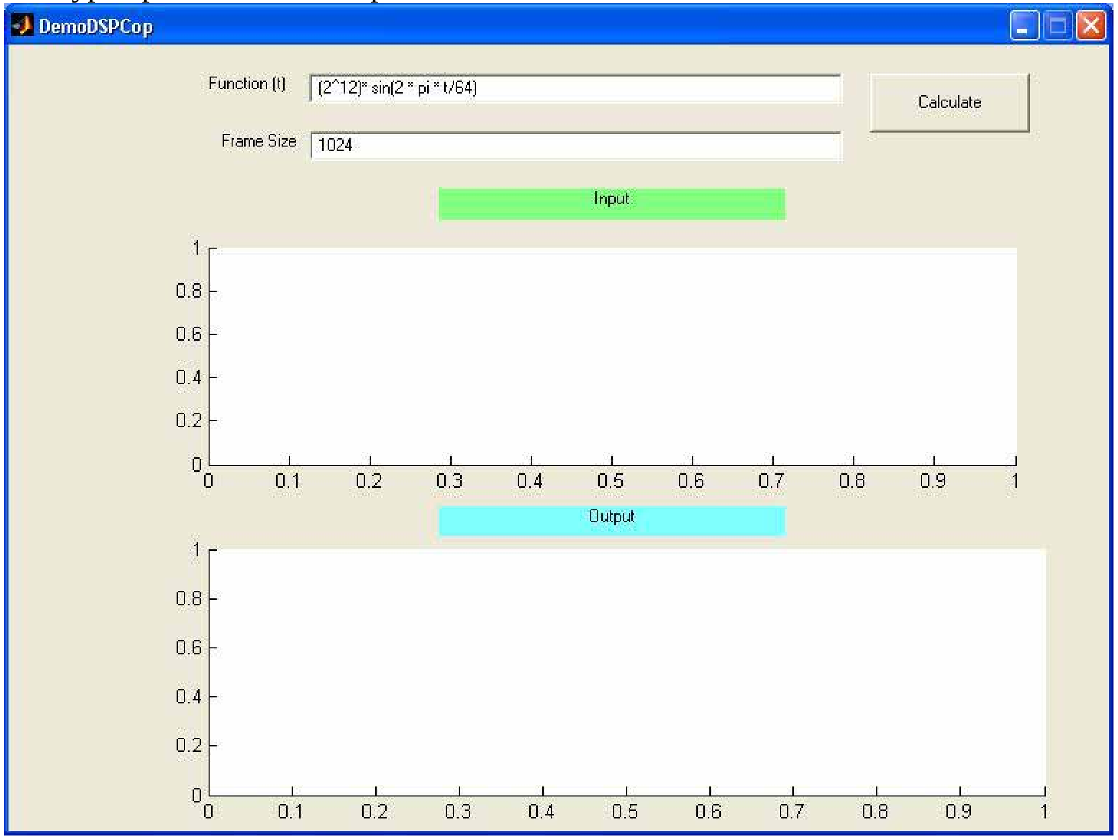


Figure 9 Matlab Demo Window

4- Generate code for it (simulation->configuration parameter and …)
5- Compile code, load it and run the code (in CCS)
6- Type open DemoDSPCop.m in Matlab window:



Function (t) (2^12)* sin(2 * pi * t/64)

Frame Size 1024

Figure 10 Demodspcop results window

7- Press calculate. The data related to the function that you entered is calculated and sent to DSP, the DSP calculates the FFT and returns the result for displaying.

Something that you can do with this demo:

1- Change the function. The function is any valid Matlab function with t as the variable. For example the followings are valid functions:
   - t
   - t+100
   - Sin (t *100)

   Some interesting functions are:
   - 2^12 *sin ((t-500)/20)
   - 2^12 *sin (t/5)*(1+0.8*sin (t/50))
   - 2^12 *sin (t/5 + 2 * pi * sin (t /50))

Demo Hardware in the loop.

In this demo, some section of the demo is running in the PC and some other section is running in the DSP.
This demo has 3 files:

1- Mic.mdl: The model for PC section that uses a microphone as input
2- File.mdl: The model for PC section that uses a file as input.
3- Reverb.mdlTthe model that should be run in the DSP.

Running the model:

If you have a full duplex sound card and a good microphone use mic.mdl otherwise use file.mdl.

1- Open Matlab and change its directory to hardware_in_the_loop directory.
2- Open reverb.mdl and generate code for it.
3- Compile, load and run into the DSP with CCS.
4- Open Mic.mdl or file.mdl.
5- From its window select simulation->start and then speak into the mic (or listen to the speaker if you are using file version).