

## Alpha accelerator for RTW – Windows Target

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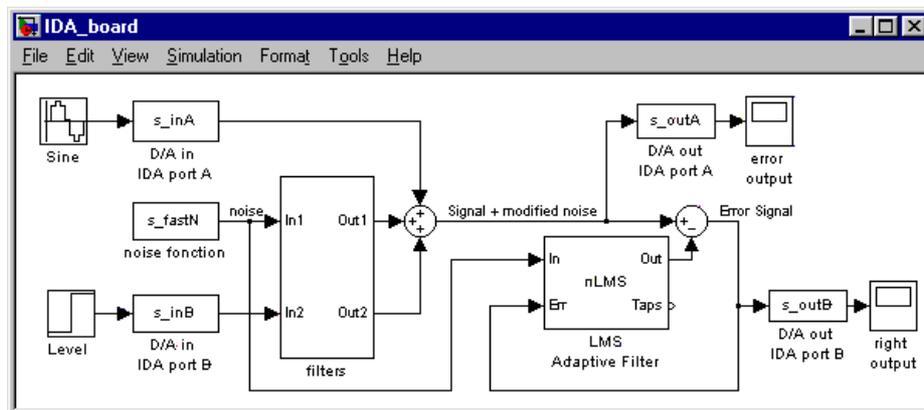
### Introduction

This article describes our environments and extensions of the Real Time Workshop (RTW) and the Windows Target (WT) toolbox. There are two hardware platforms (boards) on which we target our Simulink files. The first is so called 'IDA board' based on C31 from Texas Instrument and the second is 'AD66-PCI' from Alpha Data. There is a big difference between these two platforms in performance but this article do not focuses on this difference. What it does is the description of specific software implementation. It is demonstrated on adaptive echo cancellation demo.

The demo algorithm has been implemented on the IDA board first. It is described in the 'IDA board' section. The second hardware platform is AD66-PCI. It is described in the 'AD66-PCI card' section.

### IDA board

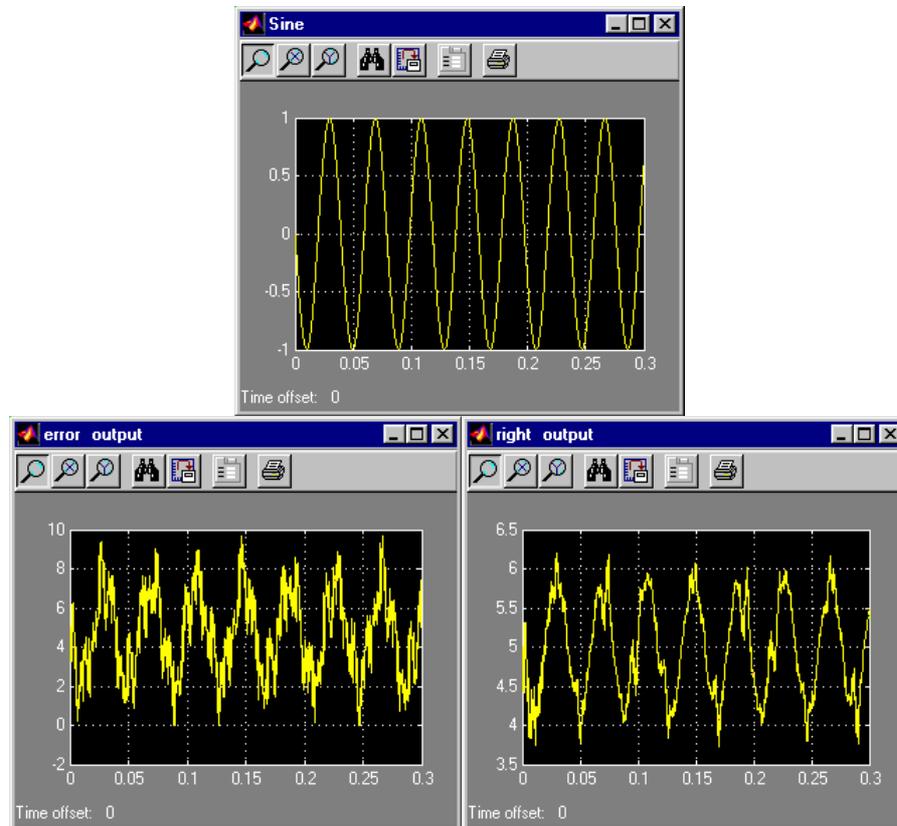
This board is built on C31 DSP processor from Texas Instruments. It is connected to the PC by a serial line. The board has two analog inputs and two analog outputs. The RTW was used with this board to export the Simulink's blocks to it. This board then works independent from PC (this is usually called embedded application).



**Fig. 1 Adaptive noise Cancellation Demo on IDA board**

The brief description of model is described now. It is important to say that blocks Sine, Level, Error output and Right output represented the signals on inputs and outputs of IDA board. There is a useful input signal (Sine) in the model. To it is added a variable noise. This variability is implemented by block Level. Demo reconstructs an input signal.

As was mentioned it is possible to compile and download the application (Simulink's model) to the IDA board (embedded system). But it is usually useful to simulate it before. It is possible in Simulink as usual. The results are shown on the following figures.



**Fig. 2 Input sine signal, error output and right (corrected) output**

As soon as the simulation is finished it is possible to compile and download it to the IDA board. The application can run in real-time on the IDA board now. As was mentioned above, the IDA board works on PC independently (the use of RTW's external mode is not implemented). The advantage is that the process time decreased. The disadvantage is impossibility to collect data in real-time to the PC for monitoring. It is not possible to control the IDA board in real-time from PC, too. Data can be collected to the buffer and uploaded when the process of application is finished.

## **AD66-PCI card**

This card is built as classical PCI card for PC. We can use it to accelerate the number crunching process of Simulink because the PCI interface is fast enough. The speed of IDA board's serial interface has been the reason why we have not implemented the same support for IDA board.

The RTW is used to export the Simulink model (code) for the AD66 card as it was with IDA board. But we have implemented the low-level connection with the WT in this platform. WT provides the real-time process control on the PC side.

The same demo has been chosen. It will demonstrate how the user has to change his implementation of algorithms in Simulink. The schema has to be separated to the two parts. Each part corresponds either to PC or to AD66 side.

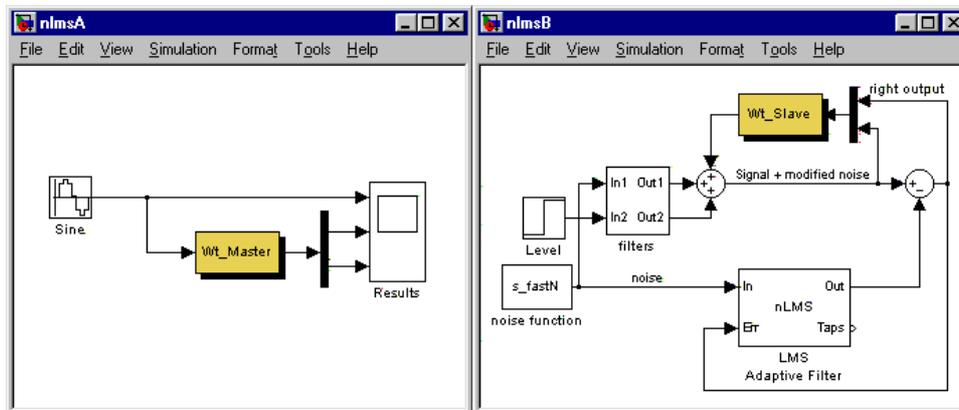


Fig. 3 Echo cancellation algorithm on PCI with AD66

The first part (left) corresponds with the PC side and the second with AD66-PCI. The communication between PC and the PCI board is hidden in Wt\_Master and Wt\_Slave blocks. These blocks are parts of our 'ad66\_lib' library. This library was presented first in [ 7 ]. The library is shown on the Fig. 4.

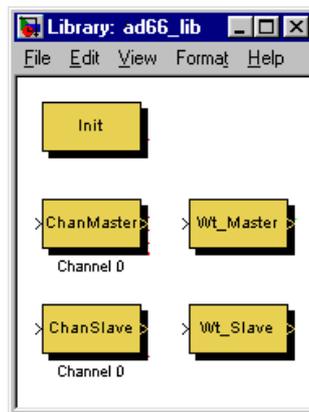


Fig. 4 Library for AD66-PCI board

The simulation's results are shown on the following figures (Fig. 5).

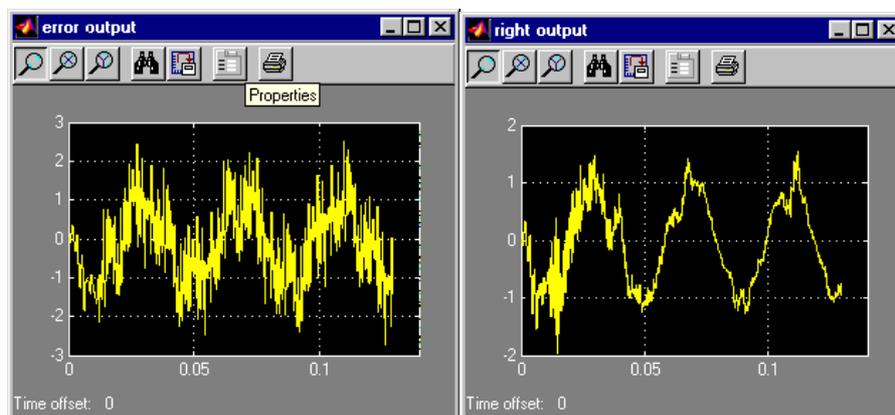


Fig. 5 Simulation results on PC with AD66

This simple part just increased the performance of WT by locating of the computational load on AD66. But we did not use the external mode's advantages. The external mode is a mode of RTW. It is supported by WT, too. It allows to change parameters of your real-time application on-the-fly.

To be able to tune the parameters it is need to change the Simulink's schemes again. It is used for the comfort tuning of external mode of RTW running in real-time on PC. See the Fig. 6.

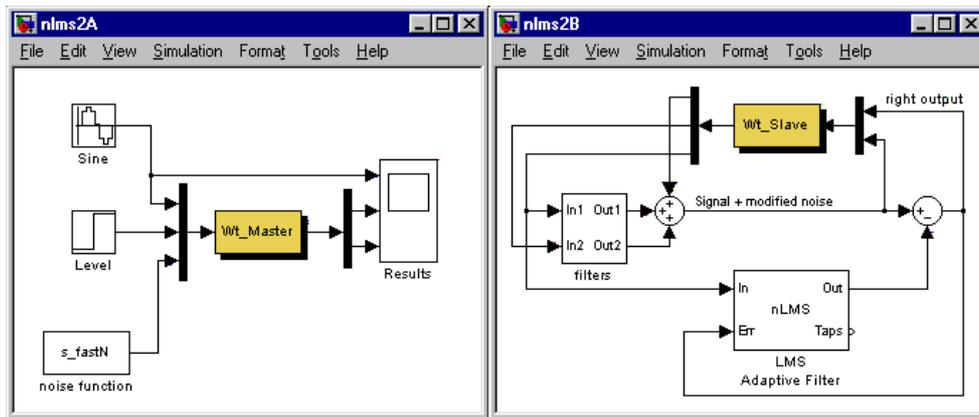


Fig. 6 nlms algorithm for external mode

AD66 input and output blocks were up to this time virtual. With the WT the simulation gets the real-time dimensions. WT provides connection of different I/O cards placed in PC. It is possible to connect the virtual PC's word with the outside real. The following picture shows the modification on PC side.

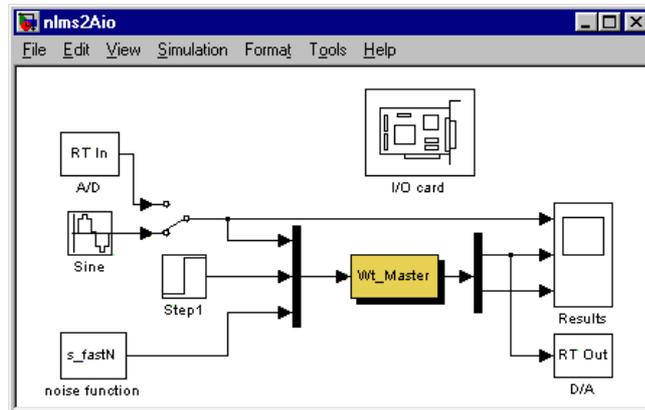


Fig. 7 PC with AD66 and I/O card

### Basic hardware and software which was used

Hardware	Description	Corporation
AD66-PCI	Accelerator	AlphaData
AD512	data acquisition card	Humusoft
PLC-1800	data acquisition card	Advantech
IDA Board	board based on C31 TI	S.E.E.R Paris

<b>Software</b>	<b>Version</b>	<b>corporation</b>
Simulink	3.0	MATLAB Toolbox
Real-Time Workshop	3.5	MATLAB Toolbox
Real-Time Windows Target	2.0	MATLAB Toolbox
MSVC	6.0	Microsoft
Windows 98		Operating System

## Conclusion

The Windows Target toolbox gives a good possibility to use the PC with user known operating system and software as the real-time tool. You can easy connect different technologies and analyse them in real time with your PC. We are able to use and accelerate it with the PCI boards. Especially with AD66-PCI, now.

## References

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