Hardware and Software platform for Real-Time Processing and Visualization of Automatic Ultrasonic Signal Evaluation in NPP

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1. Introduction

In this paper the architecture of a hardware and software platform for ultrasonic wave evaluation is presented, which is under developing as a part of the project for the development of automatic ultrasonic wave acquisition and analysis and evaluation system. The platform, used in conjunction with an analog front-end hardware for driving the ultrasonic transducers of any commercial device(*μ*-Plus II & MDU II, Veritec, England), having the radiofrequency echo signal access, makes it possible to dispose a powerful ultrasonic system for experimenting any process technique. The platform will be more efficiency system through tuning of the automatic ultrasonic hardware and evaluation software. The evaluation software is supporting tool for efficiency Automatic Ultrasonic Wave Signals.

2. System Description

The general specifications of the platform are following :

2.1 General Configuration

The platform is designed to be modular, expandable, and aimed at embracing challenging the ultrasonic examination techniques. The modularity and expandability are designed both in hardware and software. To replace or add the new digital boards and software modules, various methods are investigated.

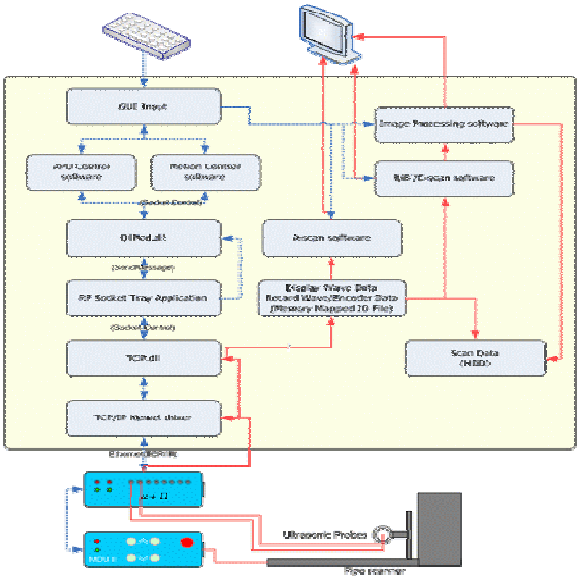

Figure 1. General configuration

2.2 Hardware Platform

The platform completely integrates the architecture of a personal computer (PC) giving rise to several benefits, such as the quick technological evolution in the PC field and an extreme degree of programmability for different applications. The PC also constitutes the user interface, as a flexible and intuitive visualization support, and performs some software signal processing, by custom algorithms and commercial libraries. The realized close synergy between hardware and software allows the acquisition and real-time processing of the ultrasonic radiofrequency (RF) signal with fast data representation.

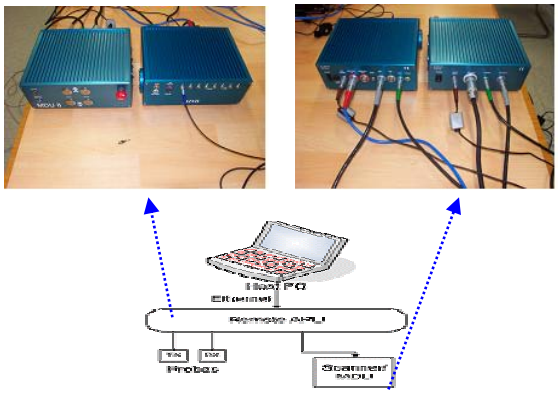

Figure 2. *μ*-Plus II & MDU II, Veritec, England

The hardware comprises both a real-time section for fast data transfer and a control section, devoted to programming, synchronizing, and calibrating for the platform hardware by the operative procedures. The fast data transfer in the real-time section devoted to transfer analog signal to digital data between the various processing modules and the PC. The control section is responsible for controlling and configuring each module in the real-time section. The hardware integration is obtained through the APU board which is capable of achieving the required fast data transfer to the PC memory.

Title	Value
Max data Amount	100 mega bit/sec
Pulsing voltage	200 Volt
PRF	50Hz~10kHz

ADC Rate	160MHz /channel
Channel	8
axis	2
Data Type	Unsigned char(1byte)

2.3 Software Platform

The software architecture can be imagined as a shell which encompasses the platform hardware. The user, through the interface, can control all modules (hardware / software processing and system information) through the software configuration panels. Users can easily coordinate the processing sequence and examination procedure through the user interface software. The software module is developed by C++ language and run under the Windows XP operation environment.

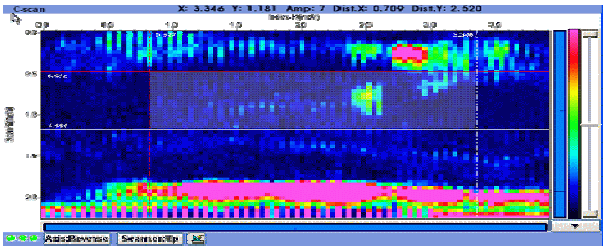

Figure 3. Statistics

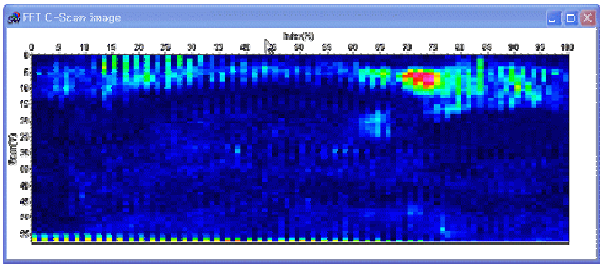

Figure 4. Fast Fourier Transform

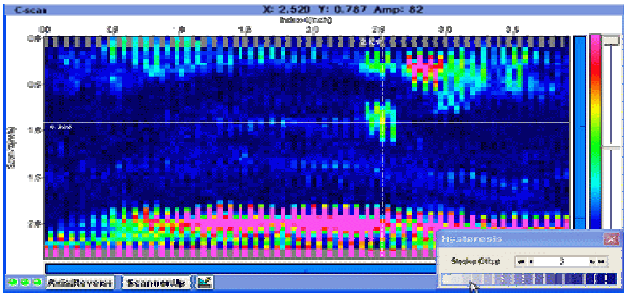

Figure 5. Hysteresis correction

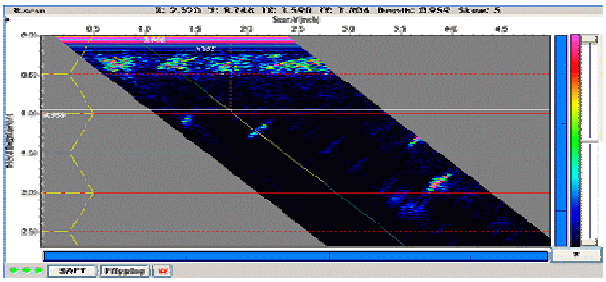

Figure 6. Weld Overlay

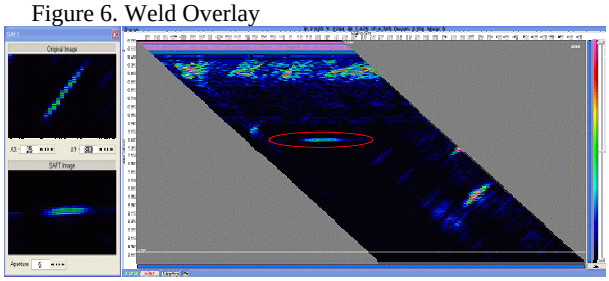

Figure 7. SAFT(Synthetic Aperture Focusing Technique)

Fig. 3,4,5,6,7 shows the ultrasonic wave evaluation visualization tools. The software architecture can be imagined as a shell, which encompasses the platform hardware. The user, through the interface, can control all modules (hardware, software processing and visualization)

through the configuration panels. The processing parameters of both hardware and software modules can be controlled not only manually by the user but also automatically by results produced by other software modules. In fact, as can be observed in Fig. 3, outputs of the processing block can be directed to the configuration shell.

3. Conclusion

In this work we have presented ultrasonic wave evaluation system as a unique apparatus for carrying out the research such as both in detect the flaws in the component and piping welds in NPP and ultrasonic technological developments.

The platform is the composition of a hardware real-time section and a software section controlled by a totally integrated PC. All system are designed to be modular and expandable for embracing challenging ultrasonic examination techniques and ensured by ASME Code sec. XI, App. VIII, Performance Demonstration in Korea to be applicable in the nuclear power plants.

REFERENCES

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