A High speed, high bandwidth Versatile DAS for breast cancer detection

Jinling Xing, Nan Li, Wang Wei, Mingqian Wang, Danyang Jiang, Hui Xu, Xiaolin Zhang

National University of Defense Technology, Changsha, China, xjl@nudt-esss.com

Abstract: The data acquisition system (DAS) developed aims to get the 3D breast cancer tomography with 8 current injection channels and 117 voltage measurement channels, capable of generating and measuring voltages and currents. By adopting special electrode and careful circuit layout, the initial bandwidth without calibration can reach 5 MHz. Electrical test results show that the system has a SNR greater than 67dB at 5MHz without digital enhancement method.

1 Introduction

Electrical impedance tomography (EIT) is a medical imaging technique which displays the spatial distribution of the complex conductivity inside a body [1]. For previous EIT system [2][3], the main problem is the speed limitation on the data transport path between the tomography computer and DAS, which affects image construction speed and later digital progress. By contrast, the system adopts PXI-Express protocol as the data transport path whose data transferred speed can reach 400MB/s, thus the measurement rate of the systems can easily reach 100 frame/s. In addition, high flexibility can be got by applying the PXI-E structure. The system diagram is illustrated in Fig.1. NI signal data acquisition subsystem consists of a NI-PXI-E case, a versatile DAS card, a multi-channel DAC card and a NI computer controller. The system principle is as follows. First of all, Electrode driving circuits inject current excitation into human body through electrodes, and then the versatile DAS cards get the feedback electrical potential signals and transmit the signals to the NI computer controller. The actual system is illustrated as Fig.1 and Fig.2 respectively.

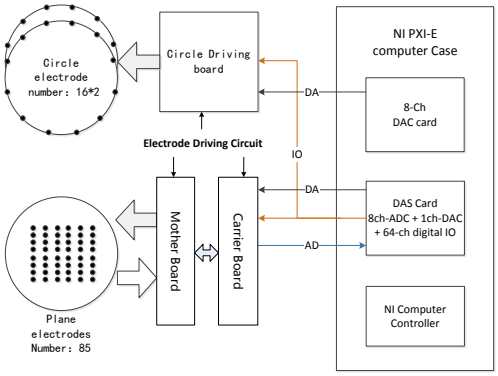

Fig.1 overall design diagram

2 Methods

Versatile DAS card contains features: 8-channel ADC, 1-channel DAC, 64-channel digital I/O ,as shown in Fig.3.

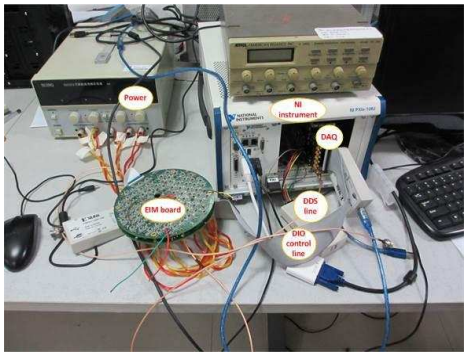

Fig .2 photo of actual DAS system

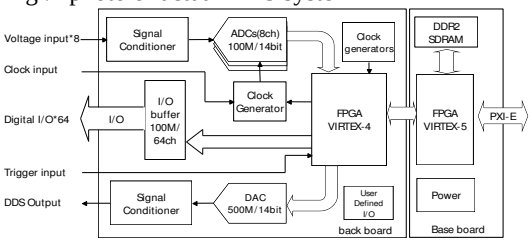

Fig.3 Versatile DAS card diagram

Multichannel DAC card is designed for outputting 8-channel analog signals with minimum voltage precision of 0.12mV, as shown in Fig.5.

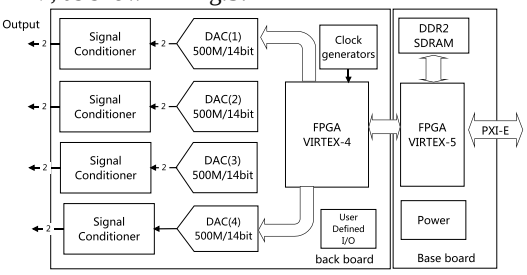

Fig.5 multichannel DAC card diagram

3 Conclusions

The paper presents the design of the data acquisition system briefly. By adopting FPGA as data processing, the system can be easy to be reconfigured, so the system can not only satisfy the need for breast cancer detection, but also can be used for other EIT applications.

References

[1] Holder, D. S. (2005). Electrical impedance tomography-Method, history and applications, Institute of Physics Publishing Bristol and Philadelphia.

[2] MEHRAN G OHARIAN and MANUCHEHRS OLEIMANI, et al. (2008). "A DSP Based Multi-Frequency 3D Electrical Impedance Tomography System." Annals of Biomedical Engineering 36(9): 1594-1603.

[3] J Kourunen, T. S. A. L. and A. L. M. Heikkinen (2009). "Suitability of a PXI platform for an electrical impedance tomography system." MEASUREMENTSCIENCE ANDTECHNOLOGY(20).