



Chapter 1

Introduction

At the present, imaging by nuclear magnetic resonance (nmr) is altering the radiologist's perspective. It takes radiologist from the electrorr to the subatomic environment of the tiny nucleus, and from x-ray radiation to radio frequency fields, a variation of some ten orders of magnitude in terms of wavelength and frequency. NMR may allow radiologists to diagnose diseases with greater sensitivity and specificity. In viewing of the fact that nmr has no known intrinsic hazard compare to exposure to high energy photon in the x-rays method, nmr imaging is highly interested. Our laboratory is building electronics equipments to study this sophisticate techniques in detail.

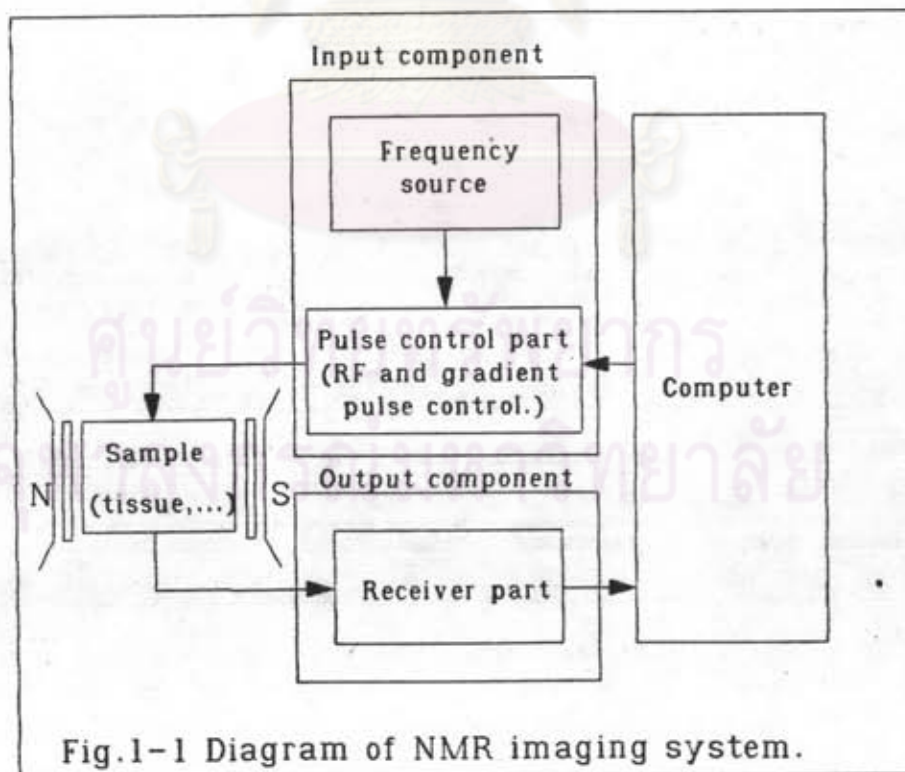


Fig.1-1 Diagram of NMR imaging system.

The diagram of main idea of nmr imaging is shown in Fig.1-1, the system consists of the input components - pulse control part and frequency source that take the pulsed signal to sample, the output components - receiver part that received the induced signal from the sample, and the computer which is used to control the function of the system and analyse the received signal into picture.

The purpose of this thesis is to build the pulse control part of the nmr imaging system. The required pulse control part or programmable pulse generator composes of a pulse programmer and pulse shaping units. Since it is required to send many forms of the pulsed signal to the sample, the pulse programmer unit together with the pulse shaping unit must be able to generate forms of pulses at various delayed time to arrived at different ports. In nmr imaging, the signals are used as data for imaging was obtained by applying various pulses of different shape in sequences. So it is necessary that pulse shaping unit can be programmed with many shapes of waveform besides the timing of the pulses. The objective of this thesis is to build the pulse programmer and the pulse shaping units, to facilitate the control part of the nmr imaging system. Details will be given in following chapters. In brief they are as the following.

Chapter 2 Principle of NMR - presents the basic theory of nuclear magnetic resonance (nmr), the magnetic interactions and the relaxation of times.

Chapter 3 NMR Imaging in theory - presents the theory of nmr imaging and the mechanism of imaging reconstruction.

Chapter 4 The role and the mechanism of a programmable pulse generator for nmr imaging - presents the requirement of nmr imaging system using programmable pulse generator, programmable pulse generator is composed of the pulse programmer that can not adjust pulsewidth, but can program pulses, and the pulse shaping that can program shape and received the starting signal from the pulse programmer, and the operation of them.

Chapter 5 Building the pulse programmer unit - where the details of working process of the pulse programmer will be explained and the entire circuit and printed circuit board of the pulse programmer will be given.

Chapter 6 Building the pulse shaping unit- where the details of working process of the pulse shaping will be explained and the entire circuit and printed circuit board of the pulse shaping will be given.

Chapter 7 Software for control the pulse programmer and the pulse shaping - presents the control process of software that written in assembly language and show flowcharts and source codes of the control program.

Chapter 8 Software for generating the data of the pulse programmer and the pulse shaping - presents the generating process of software that is written in pascal and some in assembly languages on computer IBM PC, the condition of the sending data and the maximum number of data that can be received for the pulse programmer and the pulse shaping.

Chapter 9 Discussion and summary - where the discussion and summary of the whole work is given.

Appendix A IEEE 488 (GPIB) - presents this standard communication board which is used in the pulse programmer and the pulse shaping.

Appendix B The tools that used in building the programmable pulse generator for nmr imaging - presents the method of software development on the AppleII computer and show these instruments are used in this process.

Appendix C Frequency divider - presents the working process of the frequency divider in details and presents the entire circuit and the printed circuit board of the frequency divider.

Appendix D Software for controlling the pulse programmer - presents the source program for controlling the pulse programmer that was written in assembly language.

Appendix E Software for controlling the pulse shaping - presents the source program for controlling the pulse shaping that was written in assembly language.

Appendix F Editor for the pulse programmer - presents the source program of generating pulse sequence for the pulse programmer; it was written in pascal language and this program is used on IBM PC.

Appendix G Editor for the pulse shaping - presents the source program of generating pulse shapes for the pulse shaping; it was written in pascal language and this program is used on IBM PC.

Appendix H Parser2 - presents the source program of calculating equations for the pulse shaping; it was written in pascal language and this program is used by editor for the pulse shaping.

Appendix I Send_data for the pulse programmer and the pulse shaping - presents the source program of sending pulse sequence or pulse shapes from IBM PC to the pulse programmer or to the pulse shaping, respectively; it was written in pascal language and this program is used on IBM PC.

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