CHAPTER I

INTRODUCTION

หอสมุดกลาง จุฬาลงกรณมหาวิทยาลัย

A neutron spectrometer is a powerful tool utilizing neutrons from a nuclear reactor to study of magnetic structure of solids via diffraction technique. Since neutron possesses a spin of $\frac{1}{2}$, the scattering cross-section of neutron by solid composes of both nuclear and magnetic interaction. The technique can then be used to study crystallographic as well as magnetic structure of solids. Apart from magnetic structure, more details on the structure of unpaired spin electrons of the magnetic atom can be determined by utilizing a polarized neutron beam.

A neutron diffraction pattern which yields the above results can be obtained by stepwise detection of scattering neutrons from specimen at various angles. A diagram of the experimental assembly for neutron diffraction is shown in Fig.2.1 and it comprises 4 main parts.

1.1 Inpile - Collimator : The collimator is in the Beam Tube of the reactor and is used to collimate the neutron from the reactor core into parallel beam toward the monochromator.

1.2 Monochromator Housing and Shielding : The monochromator is a single crystal which will diffract neutrons of the same energy in the same direction yielding monochromatic neutrons. The monochromator is surrounded with borated paraffin which shields the researcher from the scatterred neutrons. The monochromator can be rotated to any desired position giving neutron of specific energy.

1.3 Specimen Table and Spectrometer Arm : It consists of a semi - circular base plate to hold the sample. The neutron detector is fixed to the spectrometer arm which can be moved to detect the scatterred neutrons at various angles.

1.4 Neutron Detection and System Control : Fig. 2.2 shows block diagram of electronic parts for neutron detection. The main counting system measures the amount of neutrons scatterred from the sample while the monitor system limits the number of neutrons impinging the sample in such a way that the amount of neutrons from the monochromator incident on the sample is the same for each measurement. The measuring angle can be varied in steps of $\frac{1}{4}^{\circ}$ and $\frac{1}{6}^{\circ}$.

In principle, the neutron diffraction apparatus described above can be manipulated manually. However, due to low neutron flux and a large numbers of neutron counts are needed for a satisfactory result, it is more practical to use an automatic one. It is the task of this thesis to develop an automatic control unit which will enable the existing neutron spectrometer to be used as a conventional as well as a polarized neutron spectrometer. The main functions which will be given in details in Chapter II can be summarized as follows : -

- As soon as a preset number of neutron count in the monitor scaler (Fig. 2.3) is reached a signal should be sent to printout control to print the number of neutron count in the main scaler.

- Sequentially the motor which drives the spectrometer arm can be started or stopped according to the operation mode selected.

- The Radio Frequency Generator (RFG) will start or stop in accord with the mode of operation in 2.

- Automatically the main and monitor scalers will be reset and start neutron counting at the end of pre-programmed sequence of operation.