AEC-NASA TECH BRIEF

Mössbauer-Effect Data-Collection System

The problem:

To develop an automated data collection system for Mössbauer-effect experiments. The Mössbauer effect is an example of nuclear-resonance fluorescence in which the nuclear gamma rays are extremely sharp. It is an important tool for the study of low-lying excited states of nuclei. Various types of velocity spectrometers have been used in Mössbauer-effect measurements, but the velocity ranges are generally less than 10 cm/sec and can be as small as a few microns/sec. Involved procedures are also required.

The solution:

A general system configuration and use of a small, general-purpose digital computer for data acquisition from, and minor control of, four Mössbauer-effect experiments. The device is designed for use with four velocity spectrometers, which derive their motion from a mechanical device rather than an electromagnetic transducer. The device replaces four pulse-height analyzers operated in the "time" or multiscaler mode.

How it's done:

A small, general-purpose digital computer was used. It has a 12-bit word length and 4096 words of core memory with a memory cycle time of 2 μsec, and direct memory access. A rack-mounted oscilloscope is interfaced to the computer through two 10-bit digital-to-analog converters. The standard input-output device associated with this computer is the teletype machine, which combines the features of a keyboard, printer, paper-tape punch, and paper-tape reader.

A typical experiment would proceed as follows: First the experiment would be initiated by a Zero Reset signal from the experiment, which would set an address register and synchronize a free-running oscillator. Detector pulses would be counted by a 12-bit counter until a channel-advance pulse was received, which would cause the accumulation in the counter to be transfered to a buffer. Following the transfer, the counter would be cleared. Then the counter would start counting detector pulses for the next channel. The interface control unit would then initiate a computer read cycle, and an add would be performed with the previously accumulated total for that channel. Once the sum had been stored back into memory, the overflow checked, and the address counter incremented appropriately, the next channel-advance pulse would be awaited. This process would be repeated until the 200 Reset signal was received.

When data is being collected from more than one experiment at a time, the experiments are serviced on a cyclic request basis.

A program called Möss Control was written for the Mössbauer-effect experiments. The experimenter can communicate with the program via a teletype keyboard using coded instructions.

The system has several advantages over running the same number of experiments, each with a dedicated analyzer. The computer system is very economical with no loss of versatility to the experimenter.

It is now possible to do channel summations, spectra folding, and exact peak center determinations, which were previously not possible with analyzers. In addition, energy calculations that previously required additional computing power can now be performed. In short, the system has all the advantages of a general-purpose digital computer, in addition to performing the tasks of a wired-program analyzer.

Notes:

1. Information on the experimental interface and control program is available in "Mössbauer-Effect Data Collection System," ANL-7386, Argonne National Laboratory, November 1967. This report

(continued overleaf)

is available from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151; price: $3.00 each (microfiche $0.65).

2. This innovation would be useful in handling large volumes of data from research experiments, and thus may be of interest to persons concerned with the acquisition and processing of scanned data.
3. Inquiries concerning this innovation may be directed to:

   Office of Industrial Cooperation
   Argonne National Laboratory
   9700 South Cass Avenue
   Argonne, Illinois 60439
   Reference: B69-10027

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Patent status:

Inquiries about obtaining rights for commercial use of this innovation may be made to:

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