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AEC-NASA TECH BRIEF

Live-Timer Method of Automatic Dead-Time Correction for Precision Counting

Several applications of live-timer count correction are reported (ref. 1); they are discussed with regard to the precision and statistical accuracy of the results obtained. The method is compared to conventional real-time operation with subsequent formula correction.

Automatic correction for dead-time losses in nuclear counting experiments can often be implemented by a simple live-timer arrangement in which each counting interval is extended for compensation for the dead time during that interval. In comparison with conventional calculated correction, automatic live-timer correction claims four advantages: (1) elimination of tedious, repetitious manual calculations when no computer is available; (2) elimination of a possible source of error, whether or not a computer program is employed in processing of counts; (3) elimination of any dependence of the result upon paralysis shifts or instabilities; and (4) the possibility of immediate results, so that a series of counts can be plotted as it proceeds and inferences may be drawn quickly.

For live-timer correction to be widely acceptable, particularly for precision counting, the statistics of the automatic correction process must not be significantly worse than those resulting from the propagation of error through the usual correction formula, starting with the variance attached to the dead-time loaded channel. This is shown to be the case; the statistics of live-timer correction are derived on the basis of generating functions. For straightforward high-precision counting, the live-timer method proves to be superior.

Counting of sources that decay appreciably during the count, sometimes thought to be a case in which live-timer correction fails, can be accomplished by choice of a certain readily calculable ratio of clock-inhibit duration to paralysis. Similarly, coincidence counting with different channel paralysis is amenable to live-timer correction, with a resultant precision exceeding that of formula corrections; this is found by a slight elaboration of live-timer logic.

The automatic detection circuitry is coupled to a dual-discriminator network and an oscillator-controlled timer. These subsystems serve as input to a network of three separate logic-controlled counters and a coincidence gate.

While no system yet devised can cope with pileup in a way that would make high-precision counting entirely independent of the input rate, a live-timer correction system, in conjunction with nonretriggering discriminator, can at least eliminate other count-rate and input-spectrum-dependent offset errors that are difficult to correct by computation. The system is also easier to implement.

Reference:

1. Porges, K. G.; Rudnick, S. J.: Live-Timer Method of Automatic Dead-Time Correction for Precision Counting. Argonne National Laboratory, July 1968.

Notes:

1. This innovation may interest designers or manufacturers of radiological test equipment.

(continued overleaf)

2. Inquiries concerning this innovation may be directed to:

Office of Industrial Cooperation
Argonne National Laboratory
9700 South Cass Avenue
Argonne, Illinois 60439
Reference: B69-10612

Source: K. G. Porges
Reactor Physics Division
S. J. Rudnick
Electronics Division
(ARG-10478)

Patent status:

Inquiries concerning rights to commercial use of this innovation may be made to:

Mr. George H. Lee, Chief
Chicago Patent Group
U.S. Atomic Energy Commission
Chicago Operations Office
9800 South Cass Avenue
Argonne, Illinois 60439