Laboratory and Shop Notes

BRIEF contributions in any field of instrumentation or technique within the scope of the Journal can be accorded earlier publication if submitted for this section. Contributions should in general not exceed 500 words.

Small Sample Infrared Spectrophotometry*

DARWIN L. WOOD
The Harrison M. Randall Laboratory of Physics, University of Michigan, Ann Arbor, Michigan
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RECENT literature[1–12] has indicated the desirability of reducing the sample size for many types of infrared spectrophotometry. Commercial equipment is currently produced with minimum sample size of about 1 mm×12 mm.[13] For the Perkin-Elmer Model 21 double-beam spectrophotometer this can be reduced still further by masking the monochromator slit height down to 3 mm, giving a sample size of 1 mm×3 mm. It is not satisfactory, however, to mask in the sampling space because of difficulties in compensation of the two beams. It has, therefore, been found very useful to mask just in front of the entrance slit of the monochromator where the two beams are superimposed. Since this location is inside the cover of the instrument, the remote control solenoid mask selector mechanism shown in Fig. 1

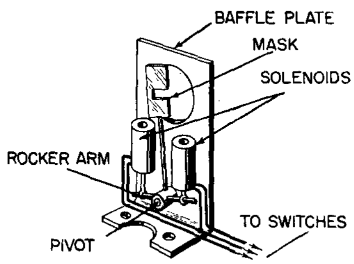

FIG. 1. Slit masking assembly.

was installed on the slit baffle plate. By actuating one or the other solenoid the short slit or full slit may be selected. The reduction in energy to about 25% causes some loss in resolution, but for most solids and many liquids the short slit and full slit spectra are identical.

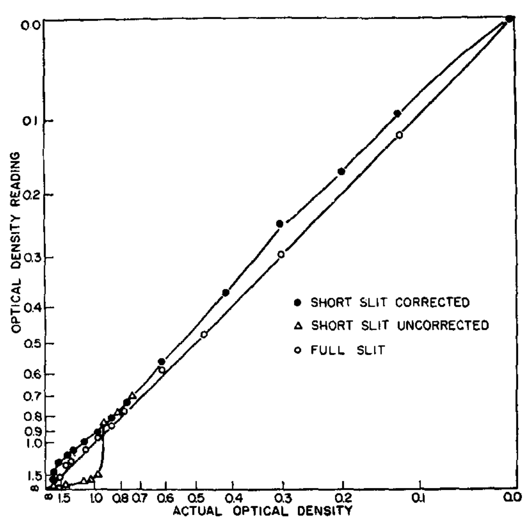

FIG. 2. Optical density calibration of spectrometer.

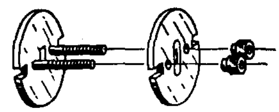

FIG. 3. Small sample holder.

On checking the intensity calibration with the short slit using a rotating sector wheel of variable aperture, it was found that the optical density readings were considerably in error above $D=0.9$ unit. This was found to be caused by the nonlinearity of the openings in the optical wedge reducing the compensating beam intensity to match that of the sample beam. By masking the wedge aperture used for the short slit so that it was more nearly triangular in shape, the calibration of the optical density scale was restored. The data are plotted in Fig. 2. The triangular points represent the uncorrected short slit calibration, the full circles the short-slit corrected calibration, and the open circles the full-slit calibration after modification of the wedge.

The sample holder for the short slit is shown schematically in Fig. 3. It consists of two plates bearing 1 mm×3 mm apertures which can be fastened together with the sample between them. The assembly fits the "microcell" adapter in the monochromator housing, and when empty transmits 100% of the no-cell energy.

With this reduction in sample size it has been possible to produce satisfactory single-crystal sections for infrared spectrophotometry in a matter of hours or days instead of days or weeks, lending considerable acceleration to our program. For liquid samples it should be possible to reduce the amount of material required by a very useful factor if suitable handling techniques can be developed.

* Supported in part by contract with the U. S. Army Quartermaster Corps.
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Attenuation and Pulse Shaping in Pulse Amplifiers

W. C. ELMORE
Swarthmore College, Swarthmore, Pennsylvania
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PULSE amplifiers used in nuclear physics ordinarily have an attenuator with a continuously variable and a step control, and a pulse-shaping network for converting step signals into pulses of limited duration. Considerations which involve minimizing noise and avoiding overload due to the pileup of pulses place both the attenuator and the pulse-shaping network at the beginning of the main amplifier (maximum gain ~10 000×), which is preceded by a remote preamplifier (maximum gain ~50×). Common practice is exemplified by the attenuator and pulse-shaping provisions of the Oak Ridge Model A-1 amplifier,[1] as shown in Fig. 1a. The capacitance C, together with the Thevenin resistance viewed from its terminals, determines the "differentiation" time constant of the network. Evidently this time constant depends somewhat on the setting of the 1000-ohm variable control. In addition, the impedance load presented to the preamplifier depends somewhat on the setting of this control. The purpose of the present note is to call attention to a simple attenuator–pulse-shaping network that has neither of these defects and accomplishes all of the desired functions.

The ladder attenuator in Fig. 1b has a constant input resistance $\frac{2}{3}R$ at each switch position. Hence the differentiation time constant $(R_0+\frac{2}{3}R)C$, where R_0 is the output resistance of the preamplifier,

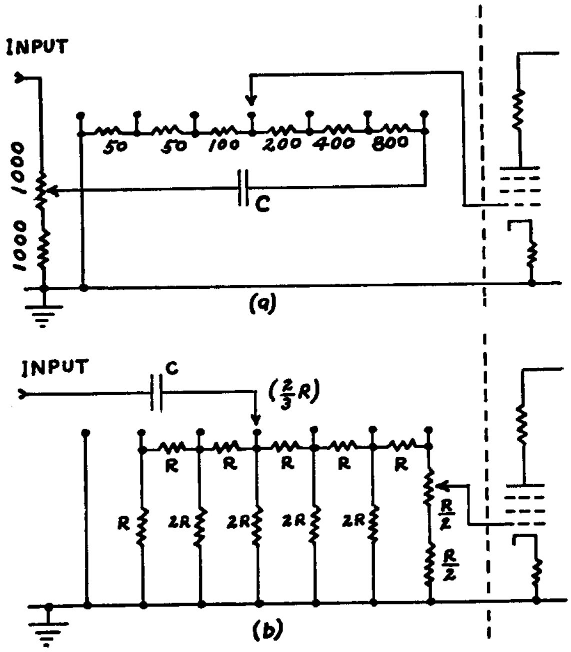


FIG. 1. Attenuator and pulse-shaping networks: (a) Model A-1 amplifier; (b) proposed method.

is independent of the attenuator settings of both the step and the continuous controls. The impedance load on the preamplifier is also independent of the attenuator settings. The network shown gives attenuation in steps of 2 with a continuous control covering each step. The resistance values in the network can be readily modified to give any desired attenuation factor per step with constant input resistance. The network does not constitute a dc load on the preamplifier, which often may be desirable. The magnitude of R is chosen to be consistent with the rise time of the amplifier. It will usually lie in the range from 1000 to 2000 ohms for amplifiers having a rise time of a few tenths of a microsecond.

[1] W. H. Jordan and P. R. Bell, Rev. Sci. Instr. 18, 703 (1947).

New Instruments

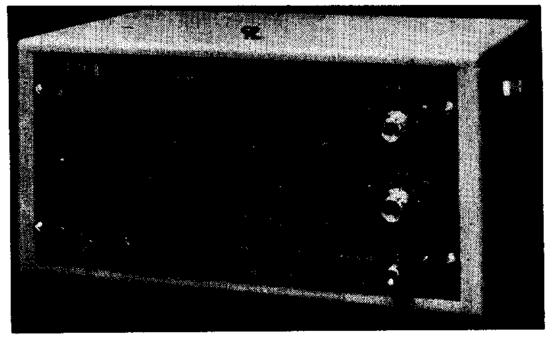
W. A. Wildhack: Associate Editor in Charge of this Section, with the assistance of Joshua Stern
National Bureau of Standards, Washington, D. C.

These descriptions are based on information supplied by the manufacturer and in some cases from independent sources. THE REVIEW *assumes no responsibility for their correctness.*

Function Generator

A variable base function generator designated Model 35 is normally used in conjunction with two operational amplifiers of the manufacturer's Model 30 analog computer to approximate almost any desired single-valued function of the input voltage. As examples, trigonometric functions, stepped functions, reciprocals, and special functions to simulate dead time and backlash may be approximated with accuracies which approach 0.5%. The instrument is not restricted to the generation of monotonic functions since biased diodes are incorporated in a bridge circuit, and functions generated for positive input voltages are independent of functions generated for negative input voltages. Both inputs and outputs may vary over a range of +100 v to −100 v.

The Model 35 approximates a function by successive additions of straight line segments. It uses 24 biased vacuum diodes which

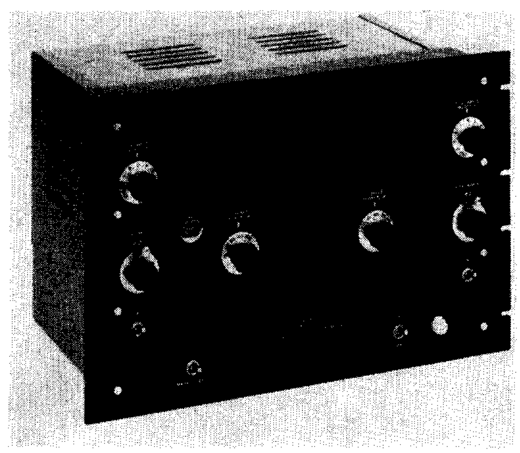


establish independent straight line variations of output voltage *versus* applied input voltage. Of the 24 segments, 12 are normally delegated to approximating the function for input voltages between 0 and +100 v and the other 12 are normally delegated to approximating the function for input voltages between 0 and −100 v. Modification of the connections to the two external computer amplifiers permits the use of all 24 line segments in the first and fourth quadrants or alternatively in the second and third quadrants. Each of the 24 line segments has a slope which may be continuously adjusted from a full positive to a full negative value of 2 v/v. Eleven line segments have intercept points which may be continuously adjusted over the range of 0 to +100 v, 11 have intercept points adjustable between 0 and −100 v, and 2 line segments have intercept points fixed at the origin.

An internal dual regulated power supply obviates the need for external dc power connections and prevents drift of the output voltage due to variations in the power line voltage. A break voltage selector switch located on the front panel facilitates setting up an arbitrary function by providing access to all break voltages. Price is $385 f.o.b. Berkeley, California.—DONNER SCIENTIFIC COMPANY, *2829 7th Street, Berkeley, California.*

Digital to Analog Converter

Operating in conjunction with a card handling machine, the Model 30A card translator automatically converts output pulses to analog voltages which are suitable for energizing the manufacturer's recorder. Plugging



directly into the recorder, the card translator contains all the relay matrices and the control apparatus necessary to control the card reader and recorder for automatic operation.

Input to the instrument is an IBM 523 summary punch or its equivalent. Conversions are made at a maximum rate of 50 cards per minute. Manual feed is also available. Plotting scale factors are 10, 20, 50, 100, or 200 counts/in. Other factors can be obtained through use of calibration controls. Calibration is by switch