Lawrence Berkeley National Laboratory

Recent Work

Title

A SINGLE-LINE SYMMETRICAL SHAPER

Permalink

<https://escholarship.org/uc/item/1m03f2b0>

Author

Goldsworthy, W.W.

Publication Date

1965-03-17

University of California

Ernest O. Lawrence Radiation Laboratory

TWO-WEEK LOAN COPY

***This is a Library Circulating Copy
which may be borrowed for two weeks.
For a personal retention copy, call
Tech. Info. Division, Ext. 5545***

A SINGLE-LINE SYMMETRICAL SHAPER

Berkeley, California

DISCLAIMER

This document was prepared as an account of work sponsored by the United States Government. While this document is believed to contain correct information, neither the United States Government nor any agency thereof, nor the Regents of the University of California, nor any of their employees, makes any warranty, express or implied, or assumes any legal responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by its trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof, or the Regents of the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof or the Regents of the University of California.

UCRL-16006

UNIVERSITY OF CALIFORNIA

Lawrence Radiation Laboratory
Berkeley, California

AEC Contract No. W-7405-eng-48

A SINGLE-LINE SYMMETRICAL SHAPER

W. W. Goldsworthy

March 17, 1965

A SINGLE-LINE SYMMETRICAL SHAPER

W. W. Goldsworthy

Lawrence Radiation Laboratory
University of California
Berkeley, California

March 17, 1965

ABSTRACT

A newly developed technique employs a single clipping line for symmetrical shaping in pulse amplifiers. It appears quite attractive from the standpoints of time information extraction, reduced amplifier loss, and considerable circuit simplification.

A SINGLE-LINE SYMMETRICAL SHAPER

W. W. Goldsworthy

Lawrence Radiation Laboratory
University of California
Berkeley, California

March 17, 1965

The employment of a single line to produce a symmetrically shaped, square-topped pulse virtually eliminates the problems associated with time matching of the lines of the normally used double-line-clipped crossover time-relating amplifier system. Since only one line is employed, all time relationships of the symmetrically shaped pulse are now based solely upon only one parameter, that of the single delay line time period.

Aside from this timing advantage, considerable simplification can be attained in the design of a symmetrical pulse-shaping amplifier. Instead of requiring two separate clipping stages, we now need employ only one. With only one line needed, problems associated with line driving and terminating are halved, and loss associated with line matching now occurs only once.

Operation

The circuit of the single-line symmetrical clipper is shown in Fig. 1. In this circuit the clipping line is driven by introducing a tailed pulse, approximately 50 μ sec long, from the output of an extremely low-output impedance feedback amplifier to the common side of the clipping line. The other (or helix) side of the line has one end tied to the ground of the driver amplifier, and the opposite end terminated in its characteristic impedance

between the line output and the ground of the driver amplifier. This arrangement provides line driving to both ends of the line simultaneously, while also providing a half-amplitude signal across the output load Z_L . The two drive signals, entering at both ends of the line, propagate down the line simultaneously in opposite directions, finally combining at fixed times later with the signal originally developed across Z_L and developing the pulse shape shown in Fig. 2D. That signal which drives the grounded end of the line is of amplitude equal to the amplitude of the driving amplifier but of reverse polarity with respect to the common line side, since the line is reverse-connected to the driver. The signal driving the opposite end of the line is likewise of reverse polarity, but of only half amplitude, since the input signal is divided equally between Z_L and the line.

With ideal line conditions and ideal drive conditions with a step-wave-form drive, the voltage developed during the first time period of the line across the output load Z_L will be half the amplitude of the input signal, flat-topped, and with fast rise. At the end of the first time period of the line, the full-amplitude reverse-polarity signal entering from the grounded end of the line arrives at the output end of the line, subtracting from the half-amplitude signal already present across the output. The resultant signal is a signal of reverse polarity and of an amplitude equal to half of the original driving signal. The other signal, which entered from the output end of the line, has now arrived at the line end, shunted by the low-impedance driver stage, and since the impedance is close to zero the polarity of this signal reverses as it reflects towards the opposite end of the line. At the end of the second time period of the line, the reflected half-amplitude inverted signal arrives at the output end of the line and adds to those signals already present across Z_L to restore the output amplitude to zero. In this manner we have developed a symmetrically shaped flat-topped pulse with only a single line.

FIGURE LEGENDS

Fig. 1. Circuit of single-line symmetrical clipper.

Fig. 2. Use of input wave forms and delays to shape the output.

Fig. 2

MUB-5973

Fig. 1

MUB-5972

This report was prepared as an account of Government sponsored work. Neither the United States, nor the Commission, nor any person acting on behalf of the Commission:

- A. Makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately owned rights; or
- B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of any information, apparatus, method, or process disclosed in this report.

As used in the above, "person acting on behalf of the Commission" includes any employee or contractor of the Commission, or employee of such contractor, to the extent that such employee or contractor of the Commission, or employee of such contractor prepares, disseminates, or provides access to, any information pursuant to his employment or contract with the Commission, or his employment with such contractor.