Comment on "Decade Rate Multiplier"

DALE HORELICK

Abstract—**The referenced letter suggests a method of achieving a decade rate multiplier with evenly spaced output pulses. Here it is shown that the proposed technique can be implemented in a straightforward manner using integrated-circuit divide-by-N counters.**

In the above letter,[1] a technique was described for constructing a rate multiplier that produces *equally spaced* output pulses; also included was a block diagram implementing the technique with subcounters and various control gates. The purpose of this letter is to describe a more general implementation of the same technique using IC divide-by-N counters such as the Motorola TLL MC 4016 decade divider. The data sheet for the divider describes how these can be cascaded to produce a division by arbitrary N, where N is directly programmed by BCD inputs.

For example, to construct a rate multiplier for $x=0\rightarrow 9$, where the lowest common multiple is $5\times 7\times 8\times 9=2520$, it is necessary to use a 4-stage decade divide-by-N chain. For $x=0\rightarrow 9$, the necessary division ratios are given below:

x	N	x	N
0	0	5	504
1	2520	6	420
2	1260	7	360
3	840	8	315
4	630	9	280

For each x it is only necessary to program the inputs of the stages with the required BCD code using an ROM, a hardwired matrix, conventional gates, or manual switches, as may be appropriate.

The advantage of this method of implementation is that it is completely general for any x and requires no custom logic design for each case. Furthermore, both the number of IC's and the number of interconnections are lower than those obtained by the previous method.

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The author is with the Stanford Linear Accelerator Center (SLAC), Stanford University, Stanford, Calif. 94305. The SLAC is supported by the U. S. Atomic Energy Commission.
[1] V. C. V. Pratapa Reddy and K. P. Rajappan, *Proc. IEEE* (Lett.), vol. 60, p. 759, June 1972.

Comments on "The Grating Array: A New Surface Acoustic Wave Transducer"

W. S. MORTLEY

The above letter[1] by Bahr, Lee, and Podell state, "In many respects, it is the invention of the interdigital transducer[1] that has been largely responsible for the current flurry of activity in the development of surface acoustic wave devices. For frequencies above about 30 MHz, the interdigital transducer is really the only practical surface acoustic wave transducer that has been available." The authors refer to a 1965 paper by White and Voltmer [1], as have so many other authors.

Unfortunately White and Voltmer were unaware of my earlier work in England. The interdigital transducer was first described and illustrated in a British patent in 1962 [2], followed by a U. S. application in the following year. It was again described at the Eighth Symposium of the AGARD Avionics Panel in 1964, but the Symposium Proceedings [3] were not published until 1966, a year after the White and Voltmer paper was published.

Publication did take place in November 1965, however, in the *Marconi Review* [4], but presumably this has only a small circulation in the United States.

The introduction to the letter,[1] quoted above, is closely related to the following statement in my 1964 paper [3]:

"*Rayleigh Surface Waves*

The comb electrode structure lends itself very well to the generation of surface waves and these have some attractive features. Perhaps the most attractive is that a simple geometry may be used, both gratings being in one plane . . . .

In spite of the disadvantages it is possible that surface waves would be useful for cheap dispersers, limited to a dispersion factor of one or two hundred, say, and a frequency sweep of about 30 mc/s."

G.E.C.-Marconi Electronics is still doing advanced computer-aided work on Rayleigh surface wave pulse compression filters, sweep generators, frequency filters, and constant-group-delay lines. Work of a similar kind is also going on in the G.E.C. Hirst Research Centre.

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[1] A. J. Bahr, R. E. Lee, and A. F. Podell, *Proc. IEEE* (Lett.), vol. 60, pp. 443–444, Apr. 1972.

Reply[2] by A. J. Bahr, R. E. Lee, and A. F. Podell[3]

We would like to thank Mr. Mortley for bringing his early work on the interdigital transducer array to our attention. In our paper the reference to the paper by White and Voltmer [1] was meant as a reference to the interdigital transducer and was not meant to imply who invented it. We apologize for the ambiguity of our statement.

REFERENCES

[1] R. M. White and F. W. Voltmer, "Direct piezoelectric coupling to surface elastic waves," *Appl. Phys. Lett.*, vol. 7, Dec. 1965.
[2] W. S. Mortley, British Patent 988 102, Application date Aug. 1962, U.S.A. Application 295 099, July 1963.
[3] ——, "Devices employing ultrasonic gratings," in *Radar Techniques for Detection, Tracking and Navigation*, W. T. Blackband, Ed. New York: Gordon and Breach, 1966, pp. 504–514.
[4] ——, "Pulse compression by dispersive gratings on crystal quartz," *Marconi Rev.*, vol. 28, pp. 273–290, Nov. 1965.

[2] Manuscript received September 5, 1972.
[3] The authors are with the Stanford Research Institute, Menlo Park, Calif. 94025.

Scattering and Noise Parameters of Four Recent Microwave Bipolar Transistors up to 12 GHz

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Abstract—**The scattering and the four fundamental noise parameters of four recent bipolar transistors with the largest f_{max} values are determined and compared for the emitter configuration. Furthermore, the construction of a variable short for the suppression of image frequencies is given.**

At the beginning of 1972 new successes in the field of microwave bipolar transistors were announced by several well-known semiconductor companies in the United States. Although the field-effect transistors are applicable to higher frequency ranges, the bipolar transistors will retain their importance. Until now, in contrast to the field-effect devices, power transistors have been mainly bipolar transistors up to 5 GHz.

The improvements of the bipolar transistors in higher gain, lower noise figure, higher cutoff frequencies, and good stability behavior are obtained by different means. As the base width is limited technologically, the optimization is partly realized by modifications of the doping profiles. According to Fujinuma and Akiyama [1] the ideal doping profile should be steplike. This ideal profile leads to both high gain and low noise, but it involves complicated processes for its implementation. In Kakihana and Wang [2] the exponential profile of the base (double-diffused type) is the optimized structure, but the emphasis is exclusively on the f_{max} value. Not only a small base resistance

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