LETTERS

Write to Letters, Radio-Electronics, 500-B Bi-County Blvd

DIGITAL SINEWAVE GENERATOR

I enjoyed the article "Digital Sinewave Synthesizer" by Steven D. Swift (**Radio-Electronics**, October 1991). About three years ago, I designed an almost identical circuit for work. I needed a precisely controlled sinewave generator that produced six specific frequencies. Based on my experience, I have some comments for the more advanced and creative hobbyists who are building this project.

I have not looked at the contents of the author's EPROM, but Fig. 2-*c* on page 44 led me to believe that his sine-lookup table contains the zero-crossing values of 80 H at 0° and 180° on the waveform. Harmonic distortion can be slightly reduced if the table is offset slightly from these values (by adding 0.5 degrees to the calculation, for example). I can prove this mathematically, but the reasoning might be clearer if you think of the zero crossings as crossover notch distortion. The rate of change of amplitude of the sinewave should be maximum at the zero crossings. It should not dwell there. The theoretical limit of the THD is 0.7% (for 256 steps in an 8-bit EPROM) if this suggestion is followed.

The author's circuit shows a discrete implementation that should work perfectly. Large programmable logic devices, such as the EP1800 series, have architectures ideally suited to the adders and registers that form the heart of the circuit. That is how I implemented my circuit. If only a few output frequencies are required, a second programmable logic device or an array of gates can be used to generate the "A" inputs to the adders. That reduces the flexibility of the circuit, but also eliminates the hassle of looking up binary codes.

If dual outputs are required, two circuits that are clocked by the same clock generator can be constructed. Those outputs can be locked together in phase, or varied in phase if an offset generator is placed between the "S" outputs and the second sine-lookup table EPROM. That then makes possible 26 discrete phases.

The author's circuit has no adjustment for amplitude or phase. Those can easily be added in one more op-amp stage. When I constructed my circuit, I had to back off from 8 bits of resolution at higher frequencies. That caused no problems because higher frequencies were nearer the corner frequency of the low-pass filter, and, therefore, harmonics caused by larger steps were attenuated anyway.

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