Letters

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The Frequency Shifting Synthesizer

I read the paper 'The frequency shifting synthesizer' in the March issue with considerable interest. The technique expounded by the authors seems to have several other applications such as the derivation of Sidereal Time.

It occurs to me that a trivial rearrangement of the system does give considerable advantages in some cases. Referring to Fig. A, if the position of the divider is changed to Fig. B, then the output frequency is now given by:

\[ f_0 = f_1 - f_0 / M \quad (f_1 > f_0) \]

so

\[ f_0 = f_1 \left( \frac{M}{M+1} \right) \]

compared with \( f_1 \left[ \frac{N-1}{N} \right] \) in Fig. B, i.e.

\[ M = N - 1 \]

However, if the reference drops out as in a Droitwich-locked frequency standard, the divider no longer stops and restarts indicating a false phase error. As there is, I believe, a suggestion that Droitwich may go to 198 kHz this technique could have useful applications.

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We welcome and agree with Mr. Priestley’s perceptive comments. The alternative f.s.s. configuration which he shows is used in our digital oscillator correction scheme (described in our reference 3†). In the case of complete loss of the input signal, the response of either configuration depends primarily upon the nature of the mixer and phase comparator used.

The suggested change in the frequency of Droitwich transmissions has arisen since the paper was prepared, but an f.s.s. is certainly ideally suited to its adjustment. The most obvious approach, particularly when modifying existing equipment, would seem to be conversion from 198 kHz to 200 kHz. In this case \( f_0 > f_1 \) and the required divider moduli would be 99 for configuration (a) and 100 for configuration (b), rendering (b) slightly simpler to construct.

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Matrix-addressed Liquid Crystal Displays

In Reference 1 I discussed novel, relatively simple drive schemes for matrix-addressed l.c.d.s, where the net drive voltage on a polarizable crystal produces an electrical aligning force orthogonal to that generated by surface-affinity effects. More recently the important new technique of two-frequency driving has come to my notice, which permits electrical drives to generate forces either orthogonal or parallel to the containing surfaces. This brief note will therefore indicate how the two-frequency method relates physically to the methods discussed in Ref. 1, what capability it can generate on its own, and how the advantages of the two approaches may be combined.

The direct-response mode may be regarded as the situation where the polarizable molecules align themselves with the instantaneous applied field in polarization and direction, whenever the field is strong enough. In the r.m.s. mode, on the other hand, the fluctuations in the applied field are fast, compared with the rotational response time of the molecule, and so the effective aligning force is defined by the mean product of the field strength itself and the polarization induced by it.

The ‘two-frequency’ method also uses ‘low-frequency’ drives, appropriate to one of these modes. However, it associates these with a super-imposed ‘high-frequency’ drive, whose period is (presumably) short compared with the polarization (as well as the rotation) response time of the molecule. This would produce a 90° phase shift in the polarization, and its interaction with the field would generate a double-frequency oscillatory agitation. However, since the torque exerted is greatest at (or near) orthogonal alignment and least at (or near) alignment parallel to the field, the mean of any resultant small cyclic movement would always be biased towards the orthogonal plane. Certainly the established fact is that such a high-frequency agitation actively drives the molecules towards an alignment orthogonal to the field. The directions of the ridges on the two face plates will then determine the orientation of the molecules in this orthogonal plane.

Thus the two types of drive oppose each other, and so permit us to use one to apply a large bias, to be overcome by the other. Note that this should not significantly alter the absolute

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