October 1970

Brief 70-10267

NASA TECH BRIEF

Equipment-Tolerant Range Code Demodulation Method: A Concept

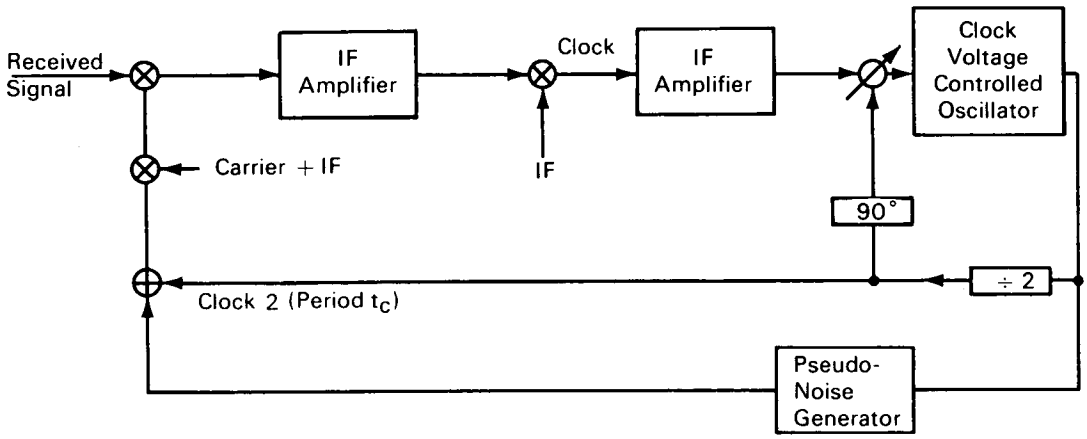

Figure 1. Existing Demodulation Loop

Certain types of automatic range-measuring systems, in particular those using pseudo-noise code (PN) modulation, are subject to errors introduced by instabilities in the receiving equipment. To minimize these errors, this concept suggests the use of a different form of reference signal in the range-code demodulation loop.

In the presently used loop shown in Figure 1, the demodulator reference signal is a locally generated PN added to a square wave whose period is twice the PN bit length (one half the clock period). The received signal carries the range-information PN, biphase-modulated on the carrier. After mixing with the reference signal, the modulation is carried through the IF amplifiers as the phase of the signal, which is eventually detected by the phase detector in the clock loop. Any phase instability of the IF amplifiers produces an error in the modulation, and hence in the range determination.

Figure 2 shows the proposed demodulation loop, which uses a reference signal composed of the locally generated PN plus a square wave of the same period as the clock. The modulation is detected in this loop as the amplitude of an IF signal whose phase is either 0° or 180°, depending on the relative timing of the incoming and the local PN. Phase instabilities in the IF amplifiers now appear only as gain changes in the loop, and hence do not cause errors in the range determination.

Notes:

1. Salient points:
   a) In the conventional scheme there are two (phase) error points, the mixer and the phase detector. One half of the phase error measurement is made at each.
   b) In the new scheme there is one error point, the mixer, and all phase error measurement is made there.

(continued overleaf)

c) In the conventional scheme, since one half of the phase error is carried through the IF, the phase instability of the IF is added before the second measurement.

d) In the new scheme, phase instability in the IF produces only a phase shift on the IF carrier and a change in loop gain. Neither has any effect on the range information.

2. This development is in conceptual stage only, and as of date of publication of this Tech Brief, neither a model nor prototype has been constructed.
3. No further documentation is available. Specific questions, however, may be directed to:

Technology Utilization Officer
Code A&TS-TU
Marshall Space Flight Center
Huntsville, Alabama 35812
Reference: B70-10267

Patent status:

Title to this invention has been waived under the provisions of the National Aeronautics and Space Act [42 U.S.C. 2457 (f)], to Motorola Inc., 4545 West Augusta Boulevard, Chicago, Illinois 60651.

Source: N. Welter of
Motorola, Inc.
under contract to
Marshall Space Flight Center
(MFS-13987)

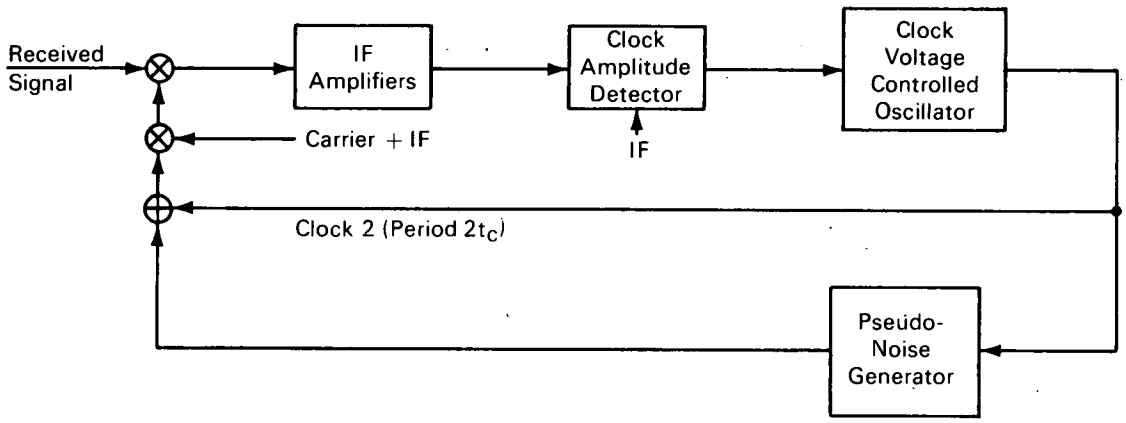

Figure 2. Proposed Demodulation Loop