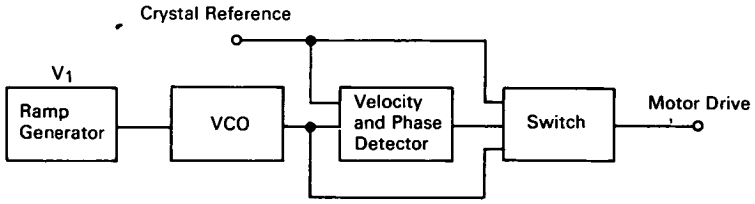
NASA TECH BRIEF

Circuit Increases Capability of Hysteresis Synchronous Motor



The problem:

To drive a load of given torque value by a high speed, high efficiency, low power drain, compact hysteresis synchronous motor. In a conventional system where it is desired to drive the load at a precise speed determined by a stable reference, this type motor could not torque the load into synchronism. Also, if the motor should momentarily drive the load into synchronism from stall, pullout torque would be too low to maintain synchronism. Proper pullout torque to maintain synchronism, in such a case, could only be obtained by starting the motor in a no-load condition.

The solution:

A frequency and phase detector circuit that determines the precise moment for switching the synchronous motor from the starting source to the reference source.

How it's done:

When the motor is to be started, the ramp generator delivers a voltage V_1 to the voltage-controlled oscillator (VCO) to run the oscillator at a low enough frequency to drive the high torque load. The ramp voltage slowly decreases, continuously increasing the VCO frequency as the motor follows in synchronism. While operating below the crystal reference frequency, the switch (composed of the velocity and phase detector) passes only the VCO frequency. When the VCO frequency and crystal reference frequency are equal and in phase, the velocity and phase detector passes only the crystal-controlled reference. All detection and switching is digitally controlled.

Notes:

1. This circuit could be used to obtain maximum starting and pullout torque for high speed headwheels and fast rewind devices in video recorder applications.
2. This technique permits driving larger torque loads with smaller motors having lower power drain.
3. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Manned Spacecraft Center
   Houston, Texas 77058
   Reference: B67-10084

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

Source: Ivan N. Markowitz
of Radio Corporation of America
under contract to
Manned Spacecraft Center
(MSC-1080)
Category 01