NASA TECH BRIEF

Ames Research Center

Subminiature Micropower Digital Recorder

The problem:

To provide a low-power subminiature recorder capable of recoding high-density digital data that are collected periodically or randomly from a multiplicity of sensors.

The solution:

Energize a magnetic recording head (or selectively energize a multiplicity of heads) with suitable pulsatile signals to reverse the polarization on magnetically-sensitive tape *while the tape is immobilized* at the recording head and then, prior to the next recording, step the tape so that a new area of tape is at the recording head.

How it's done:

Two commercially available 4-track magnetic recording heads are built into a recorder system that includes the following: (a) a pulsed magnetic motor drive which steps the tape 25.4 μm per pulse by a ratchet wheel arrangement; (b) a reel arrangement with a capacity of approximately 64 m of nominal 6.35-μm thick polyester-base magnetic tape; (c) a tape take-up mechanism; (d) suitable electrical plug arrangements for feeding electrical signals to the recording head and to the tape drive motor. The prototype device weighs 110 grams and has a volume of approximately 100 ml.

The tape loaded on the reel is prepolarized in the N–S direction through the tape. A recording pulse of suitable polarity on any recording track reverses the magnetic polarization on the tape at the recording head; when recording takes place, the tape is not moving. At the time of playback, the recorded area of polarization is read out as a recorded pulse.

In the prototype recorder, with 8 channels, storage capacity is calculated as follows: For a tape length of 64 m, or 64×10^6 μm, there are $64 \times 10^6/25.4 = 2.52 \times 10^6$ recording pulses, and 2.52×10^6 pulses $\times$ 8 channels $= 20.16 \times 10^6$ bits. The capacity in words is 2.52×10^6 when a single word is defined as a row of 8-bit spaces.

To reverse magnetic polarization local to the recording head on the 6.35-μm thick tape, the optimum pulse is 0.15 volt with a duration of 225×10^{-6} second. Measurements indicate that a single recording pulse consumes 21×10^{-6} watt of electrical power; hence, if the tape were entirely filled with recorded bits (an extreme situation), the total energy required to make such a recording is 0.09 joule. If such data were accumulated over a period of one year, average power consumption for recording would be 2.9×10^{-9} watt. If a recording-pulse circuit efficiency of only 25% is assumed, total time–current requirement for the recording pulse circuitry would be 0.6 milliampere-hour.

The magnetic motor drive for the recorder requires an electrical pulse of 2.7 volts for a duration of about 20 msec; measurements indicate a power consumption for each pulse of 125×10^{-3} watt. Again assuming a pulse-generating efficiency of only 25%, total time–current requirements for the drive motor pulse (2.52×10^6 steps in tape position) would be 3300 milliampere-hours.

(continued overleaf)

Note:

Requests for further information may be directed to:

Technology Utilization Officer
Ames Research Center
Moffett Field, California 94035
Reference: TSP 73-10491

Patent status:

NASA has decided not to apply for a patent.

Source: Robert M. Goodman and
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The Franklin Institute Research Laboratories
under contract to
Ames Research Center
(ARC-10746)