Trevor de Clercq
November 17th, 1998

Digital Audio Processing
E85.2600, Prof. K. Peacock

Chapter 9 "Art of Digital Audio" Abstract

This chapter's focus is the stationary-head recorder. As compared to the rotary-head recorder, a stationary-head recorder employs a fixed head block, open reels, a much faster tape speed, and a higher bandwidth. Basically, stationary-head digital machines are identical to their analog open reel counterparts in appearance and user operation. The advantages to stationary-head recording versus rotary-head recording, therefore, are the ability to do tape-cut edits and record 24 or even 48 tracks on a single reel of tape. Stationary-head digital recorders also offer a couple advantages over analog machines. Print through on digital tapes is not a problem. Because of this, digital tape is rather thin compared to analog. Also, the crosstalk which is prevelant in analog multi-track recording is rejected by the digital machines. In practice, their are three main formats of stationary-head recorders which have appeared on the market, the Mitsubishi ProDigi format, the Digital Compact Cassette, and the family of DASH formats. All of these formats share the general layout of a stationary-head machine.

The DASH format is probably the most commonly used stationary-head format, as seen in use on Sony's PCM-3324 recorder. The DASH I format allows for 24-tracks on 1/2" tape or 8-tracks on 1/4" tape. The so-called double density version, known as DASH II, allows for 48-tracks on 1/2" tape and 16 tracks on 1/4" tape. The digital tracks on all DASH formats are spaced close together on the tape, neither in the middle nor the edge of the tape. Auxillarly analog tracks, used for timecode and control data, are placed along the edges and center of the tape and also act as guard bands for the digital data against edge lifting. Part of the control track information includes the DASH format (I or II) and the sampling rate in use. DASH supports sampling rates of 32, 44.1 and 48 kHz. Originally, a 50.4 kHz rate was adopted for ease of professional compatability with the consumer 44.1 kHz standard, but this rate was dropped once arbitrary sampling-rate conversion became feasible.

The main difficulty with stationary-head recording is encoding the digital data with error correction techniques that will support tape splice editing. With tape cut edits, not only are two unrelated streams of digital data abutted against one another, but large dropout areas occur as the result of fingerprints from tape handling. Interleaving is the best method to combat burts errors from things such as fingerprints, but interleaving is not compatible with tape cut editing. One way of overcoming the tape editing dilema was to recorded the incoming samples twice. The interleaving process for both tracks, however, would be reversed and exactly opposite one another. Therefore, if all the odd samples were destroyed on one track and all the even samples destroyed on another, a full bandwidth signal could be reconstructed from the remaining information. Another method of error correction in DASH was through the use of cross codewords. A P codeword would be written across the track while a second (Q) codeword would be derived from the diagonal sum of the horizontal tracks. Through this method, a sort of domino effect type of error correction will significantly protect against both burst and random errors.

The Digital Compact Cassette medium was designed to play existing analog compact cassettes and digital recordings. To achieve this compatibility, the DCC needed to use data reduction of one-quarter since the tape speed of a conventional cassette is incredibly slow (1 7/8"/sec). Because of the data reduction used in the DCC and the decrease in analog cassette sales since the advent of the compact disc, the DCC format was not very commercially successful.