Trevor Owen de Clercq   Digital Audio Processing I
October 6th, 1998   E85.2600, Prof. K. Peacock

Research Report #4

  The mini-reports given last week by other members of our class gave me some insight on the direction my research project should take. I decided to focus more on a specific piece of hardware related to digital audio. Since my interests lie in the recording of music, I wanted to pick a piece of hardware that was crucial to the recording industry. With digital multitracks, the audio industry has yet to settle upon a preferred format. For digital mixdown, however, the industry standard has (for more than a decade) been the Digital Audio Tape Recorder. More pertinently, since Tascam recently released a 24-bit DAT Recorder at NAMM this summer (1998), this format will probably continue to serve as the primary means of storing professional mixes of stereo music.

  To learn about the new capabilities of Tascam's 24-bit recorder, I accessed their informative web site. The new DAT machine, model number DA-45HR, seems very similar in functionality to previous models except for the increased sampling wordlength (and thus increased fidelity). Digital and analog inputs and outputs are provided, along with most of the same front panel controls. Thankfully, the DA-45HR will be able to play and record in a 16-bit mode which will make it compatible with pre-existing machines. No sample reviews or other information were provided, so I will have to access some recent articles to gain more insight into the benefit of this release.

  To appreciate the 24-bit DAT machine, one needs a thorough understanding of the basic mechanics of DAT technology. The recorders on today's market are uniformly R-DAT machines which means that they are [R]otary-head DAT machines. Another type of design, though now out of use, is a stationary head as employed on the S-DAT. The R-DAT is superior to the S-DAT because of the increased data storage capabilities. Where S-DAT needed to consume 83 inches of tape per second, R-DAT needs only about 1 inch per second. This difference translates into very compact and affordable tape cartridges for the R-DATs.

  Historically, the DAT player was introduced to the market in 1987. A DAT Conference in 1986 had specified the standard sampling rate of 48 kHz and a standard wordlength of 16-bits. A sampling frequency of 44.1 kHz was not initially introduced due to the fear of digital copying of compact discs (who run also run at 44.1 kHz, of course). After a few years, the Serial Copy Management System (SCMS) was introduced to copy protect consumer DAT's from multiple digital generations. Because of SCMS, manufacturers could safely incorporate the 44.1 kHz rate to their recorders without too much fear of CD pirating.

  The mechanics of DAT players and recorders are borrowed not from the cassette tape industry but from the VCR industry. Cassette tapes unfortunately do not have enough information density to sustain the 2.5 million bits/second required of digital tape storage. VCR technology, which records information on parallel diagonal bands across the tape, allows for a higher density of information per inch. The guard bands of unrecorded information on cassette tapes, necessary for the prevention of crosstalk, also reduce the information density capabilities of magnetic tape. To avoid this problem, DAT machines

employ what is known as "azimuth recording". With azimuth recording, the two heads (mounted on the rotary drum) are aligned at different angles. Since magnetic flux is related to the angle of incidence, heads at skewed angles will reduce the amount of magnetic interference from neighboring tracks and thus the amount of unwanted crosstalk.

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