

Quiz

Review of Previous Quiz

On MPEG.

1. MPEG stands for Motion Picture Experts Group
2. What is the major difference between JPEG and MPEG? JPEG is I-coded (spatial). MPEG is both spatial and temporal. Difference between motion-JPEG and MPEG? Motion-JPEG is just I frames; no temporal compression.
3. Which of the three pictures is used at scene cuts? I. I pictures are self-contained and don't reference any other frame.
4. Which of the three pictures is forward predicted only? P.
5. List the three pictures in order from least to most compression. I, P, B.
6. By averaging two pictures in the backward and forward prediction methods we can realize an improvement in what? Signal to noise ratio. Noise reduction.
7. A GOP must have at least one ____ picture? I. See question 3.
8. Which picture(s) concentrates on the removal of spatial redundancies? I
9. Which picture(s) concentrates on the removal of temporal redundancies? P, B.
10. What is the formula associated with the 601 data stream? (Y sample rate + R-Y sample rate + B-Y sample rate) * bits / sample = bit rate. $(13.5 + 6.75 + 6.75) * 10 = 270$. What's the rate for HD? 74.25 MHz for Y is probably what's defined as HD-SDI.
11. What was the reason for the selection of MPEG-2 over MPEG-1 for television? Comes down to the interlaced portion of television. There is the zigzag and alternate reading schemes for the quantized DCT matrix; the alternate scheme may be the one for interlaced and the zigzag is for progressive, but this is only Steve's supposition.

Continuing with Lecture

What do we keep in composite video? Burst and sync. Why do we keep all this stuff in composite video when we digitize it? So we can reproduce color (using burst) and where active video is (using sync).

Must also keep the relationship between subcarrier and horizontal sync (SCH). Why do we throw this away in component digitized video? They are not interleaved with each other. Component encodes R-Y and B-Y and Y separately.

What is the sync word? 3FF, 000, 000, XYZ. Could either be SAV or EAV. Active video can't use these values. Possible this could happen, but very unlikely that an active video sample would have a 3FF (fully on) followed immediately 000 (fully off). Even if this were to happen, would mark EAV so video would stop. We are responsible for making the adjustments to prevent these values from being used; the analog to digital converters will convert whatever you put into them, so you must set up video to put the Y/R-

Y/B-Y into the right range. Converter companies likely don't have the time to make a foolproof converter so to save money they operate on the principle of garbage in, garbage out; it's the engineer's job to make sure garbage does not go into the converter.

More Review

What's different about a vector scope for NTSC vs. HD? Might have a wider B-Y axis in HD than in NTSC since NTSC has R-Y at 1.5 MHz and B-Y at 0.5 MHz. Won't have an I and Q axis on HD.

Big confidence areas on vector scope was meant for VTRs. As technology got better, the 20% area got smaller and smaller.

Horizontal phasing on the CCUs is really adjusting the SCH (relationship of subcarrier to horizontal sync phasing). Actually the adjustment matches the relationship that already exists in house sync.

One good thing about BTV having multiple brands/models of studio cameras is that we can see how different cameras have different designs. For example, camera number 3 has a B-Y axis response that is a bit low. This you likely won't see in a commercial studio since they will have all cameras the same make and model.

What is bowtie used for? Shows amplitude and phase of three channels. If gets asymmetric, shows you that color and phase are somehow wrong.

Sequential Y R-Y B-Y display on a waveform monitor. Called the **parade display**.

Video Elementary Stream

The output of an MPEG-2 video encoder is known as an Elementary Stream (ES). Contains all the information necessary to produce a decoded video signal. Has no audio.

Lowest-level entity in stream is coded block of DCT coefficients. Each block terminated by end of block code and four luminance and two chrominance blocks in the macro block are simply concatenated.

Coded blocks preceded by macroblock header which contains all the control information belonging to the macroblock: spatial address, motion vectors, prediction modes, field/frame DCT mode, quantizer step size. The result is a coded macroblock.

Macroblocks + Slice Header = Slice

Slice is set of consecutive macroblocks preceded by a slice header. Slice is **smallest entity in ES on which synchronization can be attained**. Slice header **contains a unique start code** which cannot be duplicated elsewhere in the bitstream. Usually one slice for each row of macroblocks, but in error-prone channels or other apps where quick resynch is very important, it is possible to have several slices per row, even one slice per macroblock.

Pictures

Slices are then grouped together into coded pictures. Picture header has unique start code and contains

picture-specific control information: whether picture is field or frame, picture coding type (I, P, or B), quantizer weighting matrices.

Within Picture Header

Video-locked master clock at encoder side drives a counter whose value is periodically multiplexed into the **transport stream** as the **Program Clock Reference (PCR)**. It is transmitted without passing through large ES encoder buffers (added late in the encoder) and it is demultiplexed early before the ES passes through any large decoder buffers, so it has a **minimum and fixed overall time delay**. The demultiplexed value is compared with a locally generated count and the difference is used to control a local PLL clock generator. In this way the decoder clock is kept in sync with the encoder clock, at least until the viewer changes channels.

Lunch

Early.