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TITLE : A CONSIDERATION ON TRANSMISSION ERROR PROTECTION FOR 384 kbit/s CODEC

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1. Introduction

Sub-primary rate coding requires a lowest possible redundancy for transmission error protection, as well as a highest possible source coding algorithm, since the available bitrate is so low as 384 kbit/s. Document #21 has already suggested that 'demand refresh' method is effective for this purpose. This contribution describes an error evaluation method and a requirement for error correcting code design when 'demand refresh' is applied.

2. Refresh methods

Protection methods for transmission errors are classified into the following two categories;

a. Usage of error correcting codes to reduce transmission bit error rate, and
b. Usage of refresh to recover errors which can not be corrected by the abovementioned error correcting codes.

If a highly efficient interframe coding system is suffered by residual errors which could not have been corrected by error correcting codes, serious damage appears in the reproduced picture. One of the simplest way to recover this damage is to use 'cyclic refresh' where both of the coder and decoder frame stores are periodically updated by PCM or intraframe DPCM words. When 4 bit DPCM words are applied for the system transmitting 100k pels ((360+60)x240) in a video frame period (1/30 sec), the extra bitrate required for updating every 5 seconds is 80 kbit/s. This value amounts to 25% of the 320 kbit/s assigned for video signal transmission in 384 kbit/s CODEC.

On the other hand, 'demand refresh' is a method that decoder sends a command requiring coder to refresh its frame store if, for example, a parity error between coder and decoder frame stores is detected. Availability of some type of two way channel is presupposed. Since this demand refresh command is initiated only when uncorrected error is detected, it never affects the bitrate for video signal transmission.

3. Requirement for error correction

When a demand refresh is initiated, the decoded picture is frozen first and updated subsequently. Since the change to be observed on the reproduced picture lasts only for a short time, its frequency can be a good measure for evaluating the performance of error protection system. For the given bit error rate of a transmission circuit, the error correcting codes should be so designed to give, for example, less than one occurrence of demand refresh during an average length (such as one hour) meeting. This performance objective should be determined from the human factors point of view.

4. Example

Mean time between demand refresh occurrence is illustrated in Figure against transmission bit error rate when BCH error correcting code is used. If performance objective of less than one occurrence per hour is applied as an example, it is concluded from this figure that;

a. for bit error rate of 10^{-6}, (255,247) with 3.14% redundancy or (4095,4072) with 0.59% redundancy is necessary, and
b. for bit error rate of 10^{-5}, (255,239) with 6.27% redundancy or (4095,4060) with 0.88% redundancy is necessary.

5. Conclusion

'Demand refresh' method has been shown effective for 384 kbit/s coding as an error protection method to recover damages remaininig in the decoded picture due to transmission error. Requirement for designing error correcting codes has also been described.

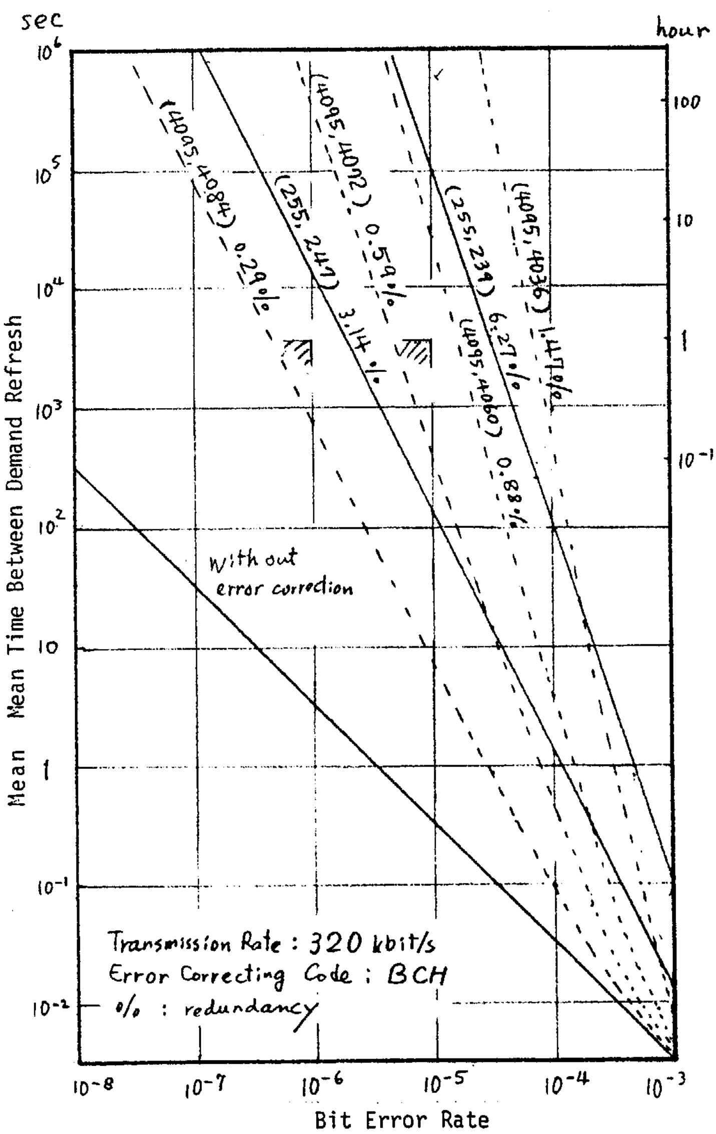

Figure Mean time between demand refresh