

means for indicating the numbers of defective packets in said packet signals sent to said transmitter;

means for loading error free detected packets onto a receiver packet carousel; and

means at said transmitter for transmitting a replacement for a defective packet by interspersing it in the normal sequence of transmitted packets.

16. The system of claim 15 wherein said packet carousels each comprise a fixed number of sectors and wherein said receiver skips a sector corresponding to a received defective packet and holds subsequently received error free packets on said receiver packet carousel until an error free replacement for said defective packet is received and loaded in said skipped sector.

17. The system of claim 16, wherein said transmitter includes means for terminating said forward error correcting as a function of the receipt of said packet signals from said receiver.

Description

BACKGROUND OF THE INVENTION AND PRIOR ART

This invention relates generally to data transmission systems and particularly to a method of operating a high speed data transmission system that is capable of error-free transfer of data in a noisy medium or in one containing other aberrations. The inventive method will be of particular benefit when used in a cellular telephone environment.

The prior art discloses many information transmission systems. A fundamental form is a basic telephone to convey voice frequency electrical signals over a pair of wires. Information that is transmitted over telephone lines is generally less susceptible to noise, phase changes and interruptions, than is information that is sent over a radio frequency link. Dedicated or so-called "leased lines" are telephone lines that essentially bypass the telephone switching network and are even less susceptible to noise. Accurate, high speed transfer of data in such a medium is quite realizable.

The fairly recent cellular telephone service uses radio links to interconnect mobile telephones with other mobile telephones and with conventional telephones via a telephone switching network. Mobile telephone service involves a very hostile environment. It uses frequency modulation of an RF carrier that is susceptible to interference, noise, fading, signal loss and phase shifting. While presently analog voice signals are carried reasonably well, the analog transmission of digital data, which is readily carried out over normal telephone lines, is rendered nearly impossible due to noise and other aberrations, such as those above mentioned, in the cellular telephone medium.

There are two fundamental problems in data transmission: accuracy and speed. Conventional data transmission systems are known wherein data is formulated into blocks or packets and some form of error protection, such as a check sum or a cyclic redundancy code (CRC), is appended to the data for providing a means at the receiver to determine whether the data has been corrupted or impaired during transmission. If an impaired packet is received, the receiver signals the transmitter to retransmit, beginning with the impaired packet.

There are well-known mathematical and physical techniques for compressing data to reduce the necessity of transmitting repetitive bit groupings. In data compression, a "compression table" (or "hash" table as it is colloquially referred to) is constructed of patterns of characters or bit groupings with the various patterns being identified. The pattern identifiers are transmitted rather than the character patterns or bit groupings themselves. These techniques can be shown to improve system throughput by allowing more data to be sent in a shorter time period and are in common usage. In the preferred embodiment, a system of data compression based upon the Lempel-Zev-Welch (LZW) compression technique is utilized. Information on LZW compression may be found in A Method for Construction of Minimum Redundancy Codes by D. A. Huffman, Proceeding of the IRE, 1952 and Pattern Matching in Strings SIAM, by D. E. Knuth, Journal on Computing, June 1977. There are many other treatises on the subject.

While a specific implementation of the invention has been described, it is recognized that modifications thereof will readily occur to those skilled in the art without departing from its true spirit. The invention is to be limited only as defined in the claims.

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