the TFB block, in such a way that the reconstruction after transmission in a decoder yields the input sequence with some probability P. The weighing factors are by no means limited to −1 and +1 and can be chosen freely to suit application or system requirements. Each respective weighed TFB function constitutes a component of the TFB waveform that is to be transmitted. Each of respective weighed TFB functions possesses a corresponding set of frequency components and lasts for a corresponding length of time.

[0030] Illustratively, the predetermined TFB functions could all specify substantially the same length of time, but this is not a requirement. For instance, a first predetermined TFB function could be utilized that has a different time duration than a second predetermined TFB function.

[0031] Illustratively, a set of TFB functions could be selected which fit within a predetermined frequency range. In such a scenario, the time durations of "interesting" (non-zero) parts of the functions will differ from function to function. However, centers of the interesting parts of the functions can be made to substantially coincide in time for all functions in the set of TFB functions.

[0032] Pursuant to another embodiment of the invention, the TFB blocks are transformed into TFB packets by modulating the block waveform with e.g. a central frequency of the channel to be used for the transmission of this group of bits and subsequently generating a waveform corresponding to a modulated function. Additional to or instead of modulation, processing may be added to compensate, either fully or in part, for the effect of the transmission medium. TFB blocks may also be transformed into TFB packets without applying additional signal processing to the blocks.

[0033] Illustratively the resulting packets are transmitted over a physical transmission medium. The packets are preferably transmitted in the order in which the parent blocks were constructed. Illustratively the transmitted packets are temporally spaced. Packets may be sent in a non-continuous stream. A waveform corresponding to the packet sequence is generated and physically realized on the transmission medium.

[0034] Pursuant to another embodiment of the invention, the waveform, as realized in a transmitter and distorted while propagated over the transmission medium, is retrieved from the transmission medium by a receiver. Illustratively, a distorted waveform is processed for compensation of the effect of the transmission medium on the waveform and/or demodulation with a carrier frequency and/or filtering, e.g. for limiting a frequency range of the signal, resulting in a sequence of noisy packets. Compensation for a distortion introduced by the transmission medium can be incorporated in the base functions; in such a case a collection of base functions may vary, possibly per block. Compensation for cross talk induced during transmission may be included in processing in both the transmitter and the receiver.

[0035] Accordingly, pursuant to another embodiment of the invention, receiving devices and methods are disclosed for receiving, detecting, and decoding an incoming TFB composite information stream. Both encoding and decoding may contain mechanisms for error correction. The TFB functions may be detected by the receiver based upon frequency domain characteristics, time domain characteristics, or both.

[0036] According to another embodiment of the invention, the receiver transforms a signal received on the transmission medium connecting the receiver with the transmitter into the bit sequence that was used by that transmitter for generating the received signal. This process preferably involves converting an analog signal into a sampled stream of bits. Illustratively the, digitally encoded, signal is demodulated. The sampled signal can be matched with a set of TFB functions in order to determine the weighing factor for each of the functions in the set. This results in bit i being set to 0 if that factor is e.g. −1, or to 1 if the factor is e.g. +1 (other weighing factors and protocols are of course possible and lie within the scope of the invention). Thus, an i^{th} function maps onto an i^{th} bit in the sequence generated for a single packet.

[0037] In a further embodiment determining the weighing factors provides information on noise generated in the communication link, which is then estimated and sent back to the transmitter for adaptation of the encoding, if necessary.

[0038] Pursuant to another embodiment of the invention, decoding information is extracted and the noisy packets are decoded using at least approximations of N TFB functions. Illustratively, functions used for decoding may be different from functions used for encoding. Noisy packets are decomposed into N weights, one for each of the base functions used for decoding. The resulting N weighing factors are mapped onto N bits in such a way that the input sequence is reconstructed with the probability P as described above. Illustratively, the extracted bits are processed with an error correction algorithm matching the algorithm used for encoding so that the original input bit sequence results. The resulting bits are made available as output sequence. Preferably the output bit sequence is placed in a buffer and made available for external equipment, such as a computer.

[0039] Illustratively, each of the steps involved in processing of the received signal may be carried out in an analog and/or digital fashion. The functions used for decoding may be digitized before application in decoding of the received signal.

[0040] This invention can be used to increase bandwidth capacity on existing transmission media and/or in conjunction with satellite transmission protocols. This invention has the following advantages:

[0041] (a) The channels made by modulating streams of TFB packets onto a number of carrier frequencies, each having a certain bandwidth, can be placed close to each other due to the limited extent of the TFB functions.

[0042] (b) It can be applied to any digital transmission protocol.

[0043] (c) It can be applied to any medium capable of carrying electronically-coded digital information.

[0044] (d) It can carry a large number of unique voice and data channels on a single line.

[0045] (e) It does not rely on compression to increase bandwidth.

[0046] (f) It provides a means of increasing bandwidth using existing infrastructure.

[0047] (g) It can be used to implement communication systems having the spectral properties of each of the current