a subscript indicating the integer, g_i, say, that has $\underline{e}_i$ as its binary representation; that is, $\overline{\gamma}_i=\underline{e}_i$). Define $\{d_1, d_2, \ldots, d_{2^n-1}\}$ by $d_{\underline{u}_k}=C_k$, $0\leqq k\leqq 2^n-2$, where the vector u_k is similarly used as a subscript. Since f is primitive, these correspondences are one-to-one. Then,

$$d_k = \sum_{i=0}^{2^n-1} z_i(-)^{i \cdot k},\ 1 \leqq k \leqq 2^n - 1.$$

Let

$$d_0 = \sum_{i=0}^{2^n-1} z_i = \sum_{j=0}^{2^n-2} y_j.$$

the correlation of $\{Y_i\}$ with the all-0 sequence (the "other" sequence generated by f). Then, $\{d_k\}$ is the Hadamard transform of $\}z_i\}$, which is obtained by setting $z_O=0$ and then filling the position with binary representation $\underline{e}_k$ in the vector $\underline{z}=(z_i)$ with y_k, for $0\leqq k\leqq 2^n-2$. The coefficients $\{d_1, d_2, \ldots, d_{2^n-1}\}$ are a permuted version of the correlation coefficients $\{C_O, \ldots, c_{2^n-2}\}$. Thus, the cyclic correlation of the data sequence $\{y_i\}$ and the M-sequence $\{u_k\}$ can be computed by appropriately rearranging $\{y_i\}$ and appending a 0, computing the Hadamard transform, and then permuting the transform coefficients.

APPENDIX B

$n2^n$ complex additions and subtractions are required to compute a 2^n-point FHT on 2^n points. By comparison, the number of multiplications/additions required for a complex FFT of length 2^{n+1} is approximately $5(n+1)2^{n+1}$. The FFT of the 0-padded version of $\{(-1)^{a_k}\}$ can be precomputed and thus does not carry any computational burden. The 2^{n+1} complex multiplications required to compute the product of the transforms require $4\times2^{n+1}$ multiplications and $2\times2^{n+1}$ additions. The computation of Σqk requires $2(2^n-2)$ additions. The total number of operations to perform one correlation is, therefore, approximately $2(5(n+1)2^{n+1})+7\times2^{n+1}=(20n+34)\times2^n$. The ratio of operations is therefore more than **10**. Thus, the number of arithmetic operations required for the FHT correlation is more than an order of magnitude smaller than the number required using FFTs.

As an example of the order of computation required, if the period is 1023 and the chip rate is 10.23 MHz, then 10000 1024-point Hadamard Transforms per second must be computed and their outputs processed. The computational requirements are slightly less that 100 Mflops. Also, the decoding process is parallelizable, since different symbols can be processed by different processors. Thus, multiple processors could be employed, with the received symbols (sequence segments) allocated cyclically to the available processors. Consequently, computational requirements are well within the capabilities of current technology.

I claim:

1. In the detection of a multi-sequence spread spectrum signal, a block correlation method for generating correlation values associated with a received signal and a plurality of candidate sequences, the method comprising:

receiving a signal comprising a first transmitted sequence and a second transmitted sequence;

stripping the second transmitted sequence from the received signal to form a stripped signal; and

generating correlation values as a function of the stripped signal and a replica of the first transmitted sequence at a plurality of offsets,

wherein the generating step comprises the substeps of:

padding the stripped signal with zeroes to form a first extended data sequence;

generating a first set of coefficients by performing a discrete Fourier transform on the first extended data sequence;

padding a replicated first transmitted sequence with zeroes to form a second extended data sequence;

generating a second set of coefficients by performing a discrete Fourier transform on the second extended data sequence;

generating a set of product coefficients by multiplying each coefficient in the first set by the complex conjugate of a corresponding coefficient in the second set; and

generating correlation values by computing the inverse discrete Fourier transform of the product coefficients.

2. The method of claim **1** further comprising:

determining the first transmitted sequence of the received signal as a function of the correlation values.

3. The method of claim **1** wherein the complex conjugates of the second set of coefficients are pre-calculated and stored.

4. In the detection of a multi-sequence spread spectrum signal, a block correlation method for generating correlation values associated with a received signal and a plurality of candidate sequences, the method comprising:

receiving a signal comprising a first transmitted sequence and a second transmitted sequence:

stripping the second transmitted sequence from the received signal to form a stripped signal:

generating correlation values as a function of the stripped signal and a replica of the first transmitted sequence at a plurality of offsets: and

selecting a subset from the correlation values generated.

5. In the detection of a multi-sequence spread spectrum signal, a block correlation method for generating correlation values associated with a received signal and a plurality of candidate sequences, the method comprising:

receiving a signal comprising a first transmitted sequence and a second transmitted sequence:

stripping the second transmitted sequence from the received signal to form a stripped signal; and

generating correlation values as a function of the stripped signal and a replica of the first transmitted sequence at a plurality of offsets, wherein the correlation values are generated by computing a fast cyclic convolution algorithm on the stripped signal and a replica of the first transmitted sequence at a plurality of offsets.

6. In the detection of a multi-sequence spread spectrum signal, a block correlation method for generating correlation values associated with a received signal and a plurality of candidate sequences, the method comprising:

receiving a signal comprising a first transmitted sequence and a second transmitted sequence;

stripping the second transmitted sequence from the received signal to form a stripped signal; and

generating correlation values as a function of the stripped signal and a replica of the first transmitted sequence at a plurality of offsets,

wherein the generating step comprises the substeps of:

permuting the stripped signal to form permuted data;