$$\text{sum}(M_l) = \sum_{n=1}^{l/2-1} M_l(n) \tag{16}$$

Each of $M_l(n)$ obtained by the equation (15) is normalized by using the sum (step **S56**). An arithmetic operational equation for this purpose is as follows.

$$M_l(n)/\text{sum}(M_l) \tag{17}$$

The values just obtained are set to the new values of $M_l(n)$.

On the basis of the normalized $M_l(n)$, the estimating unit **3** executes the following arithmetic operation

$$\sum_{i=1}^{p} M_l(i \cdot k) \tag{18}$$

every value ($1 \leqq k < 1/2\ p$) of k (step **S57**) (where, $1 \leqq ik < 1/2$). For example, 5 is used as a value of p. Although it is decided on the basis of a phenomenon known by experience such that in a song or the like, the harmonics components higher than the fifth degree extremely decrease, the value of p can be also properly changed or adjusted.

When a certain frequency component is regarded as a fundamental frequency component, since the components of frequencies which are two, three, four, and five times as high as the fundamental frequency ought to appear, the process in step **S57** is comparable to a process for obtaining a sum amplitude of the amplitudes of the fundamental frequency component and the frequency components which are integer times as high as the fundamental frequency.

For example, an arithmetic operation with respect to k=1 under l=L in step **S57** is as follows.

$$\sum_{i=1}^{5} M_l(i \cdot 1) = M_l(1) + M_l(2) + M_l(3) + M_l(4) + M_l(5) \tag{19}$$

The frequency regarding T=L corresponding to nT=L and n=1 in the Table of FIG. **5** or **6** is regarded as a fundamental frequency, the amplitudes of the frequency components which are derived by the Fourier coefficients corresponding to n=1, 2, 3, 4, 5 (T=L, L/2, L/3, L/4, L/5) are added, and the total amplitude is obtained. When another example is now mentioned, in step **S55**, an arithmetic operation about k=2 under l=L is as follows.

$$\sum_{i=1}^{5} M_l(i \cdot 2) = M_l(2) + M_l(4) + M_l(6) + M_l(8) + M_l(10) \tag{20}$$

The frequency regarding T=L/2 corresponding to nT=L and n=2 in the Table of FIG. **5** or **6** is regarded as a fundamental frequency, the amplitudes of the frequency components which are obtained by the Fourier coefficients corresponding to n=2, 4, 6, 8, 10 (T=L/2, L/4, L/6, L/8, L/10) are added, and the total amplitude is obtained. The same shall also similarly apply to arithmetic operations on k=3 and after k=3. As the value of k increases, an interval on the frequency base of the frequency components to be added is obviously widened.

Further, the estimating unit **3** selects a maximum one from the total values of the amplitudes of the respective values of k (or n) obtained in step **S57**, stores the selected maximum value into a variable S_{Ml}, and stores the value of k corresponding to the maximum value into a variable k_l (step **S58**). Thus, the maximum total value of the amplitudes is obtained with respect to the Fourier coefficients regarding the value of each T corresponding to the row (line-up in the lateral direction) of nT=L in the Table of FIG. **5** or **6**. Now, assuming that the sum of the amplitudes by the above equation (20) is equal to the maximum value, it is recognized that the spectrum level of the component in which the frequency according to T=L/2 corresponding to k=2, namely n=2 is set to a fundamental frequency is largest in the row of nT=L.

After that, the estimating unit **3** subtracts 1 from the value of l (step **S59**) and discriminates whether the subtracted value of l is equal to or less than the value of l/2 or not (step **S60**). If NO, the processing routine advances to step **S53**. In step **S53** subsequent to step **S60**,new l decided in step **S59** is now recognized as a value of nT in the Table of FIG. **5** or **6** as mentioned above. Now, assuming that L indicates the even number of samples and the new value of l is equal to L−1, in FIG. **5**, each pair of Fourier coefficients regarding the values of T corresponding to the row of nT=L−1 and corresponding to n=1, 2, 3, . . . is temporarily stored into the variables $C_l(n)$ and $S_l(n)$. The processes in steps **S54** to **S59** are again executed and S_{Ml} and k_l with respect to the row of nT=L−1 are obtained.

By repeating the cyclic flow in steps **S53** to **S60**, S_{Ml} and k_l with respect to each row of nT=L, L−1, L−2, . . . , L/2+2, L/2+1, L/2 in the Table of FIG. **5** or **6** are obtained.

When it is decided in step **S60** that the value of l is equal to or less than L/2, the estimating unit **3** determines that the processes with regard to the rows of up to nT=L/2+1 in the Table of FIG. **5** or **6** have been finished, selects the maximum value among S_{Ml} {l=L, L−1, . . . , L/2+1}obtained so far, and further recognizes k_l corresponding to the selected S_{Ml} as information of n to derive the pitch frequency, namely, pitch (step **S61**). Since n indicates the number of periods of the waves at an analysis length of L, the corresponding frequency can be derived from the value of k_l. The pitch frequency information derived is sent to the storing unit **4** and stored therein. At the post stage of the storing unit **4**, a print, a display output, an acoustic output, or another presentation of the pitch frequency information is carried out by an output system (not explained in detail).

Subsequently, the estimating unit **3** sets the frequency components which are derived by the Fourier coefficients $C(k_l)$ and $S(k_l)$ corresponding to k_l recognized as a pitch in step **S61** to the fundamental wave, obtains all of the harmonics components of the fundamental wave from the Fourier coefficients $C(2k_l)$, $S(2k_l)$, $C(3k_l)$, $S(3k_l)$, $C(4k_l)$, $S(4k_l)$, . . . , and eliminates those fundamental component and harmonics components from the original signal component (step **S62**).

After completion of step **S62**, a discrimination about whether the routine of a pitch estimating process should be finished or not is made (step **S63**). The discrimination can form various forms. For example, there is a form such that the routine is finished when the pitch estimation in step **S61** has been carried out the number of times designated by the user. Alternatively, it may be also possible to construct in a manner such that a fact that the whole spectrum level of the residual component obtained in step **S62** is equal to or less than a predetermined value is detected and the routine is finished on the basis of the detection result.

When it is decided in step **S63** that the pitch estimating process is not finished but is continued, the estimating unit **3** replaces the original signal after completion of the elimination in step **S62**, namely, the residual component as a new original signal which is a next target of the pitch estimation