

DESCRIPTION

Title of Invention: METHOD FOR DETERMINING CHARACTERISTIC
FEATURE QUANTITY OF THREE-PHASE INDUCTION MOTOR

Technical Field

[0001] The present invention relates to a method for determining the characteristic feature quantity of a three-phase induction motor which is required to calculate a deterioration parameter when diagnosing the state of a rotary mechanical system at the time of an operation using the three-phase induction motor as a drive source by using the deterioration parameter obtained by analysis of a current signal in operation from the three-phase induction motor.

Background Art

[0002] Conventionally, the state of a rotary mechanical system using a three-phase induction motor as a drive source is diagnosed by focusing attention on the deterioration parameters respectively defined in both the time domain and frequency (vibration frequency) domains of the vibrations generated from the rotary mechanical system. However, it is not possible to directly measure the vibrations of a rotary mechanical system when diagnosing the state of the rotary mechanical system existing in a remote place or installed in an inaccessible place. For this reason, the state of the rotary

mechanical system is diagnosed by determining a deterioration parameter from the current spectrum (spectrum pattern) obtained by frequency analysis of a current signal in operation from the three-phase induction motor and focusing attention on changes in the deterioration parameter (see, for example, non-patent literature 1).

Citation List

Non Patent Literature

[0003] Non-Patent Literature 1: Toshio Toyota, "Diagnostic Technique for Electric-Motor Driven Rotary Machine by Using Motor Current Signature Analysis (MCSA)," Takada Technical Report, 2010, Vol. 20, pp. 3 - 6

Summary of Invention

Technical Problem

[0004] For example, as shown in Fig. 4, a current spectrum obtained by frequency analysis of a current signal in operation from a three-phase induction motor with a pole number p is known to include sideband waves originating from a pole passing frequency f_{pp} on both the sides of the spectrum (on the lower frequency side and high frequency side of the spectrum of the power supply frequency f_{line} as the center) of a power supply frequency f_{line} (commercial power supply frequency). Accordingly, a relative ratio I_{line}/I_{pole} of a magnitude (a

current power value or peak height; the same applies hereinafter) I_{line} of the spectrum of the power supply frequency f_{line} to a magnitude I_{pole} of a sideband wave originating from the pole passing frequency f_{pp} is set as a deterioration parameter. Whether a rotor bar of the three-phase induction motor is damaged is then judged based on changes in the deterioration parameter.

[0005] In this case, the relationship of $f_{pp} = (f_x - f_r)p$ is established among the pole passing frequency f_{pp} , an actual rotation frequency f_r of the rotor of the three-phase induction motor (the actual rotation frequency f_r will indicate the actual rotation frequency f_r of the rotor hereinafter), a synchronous rotation frequency f_x of the three-phase induction motor, and the pole number p of the three-phase induction motor. The pole number p is determined by the specifications of the three-phase induction motor, and the synchronous rotation frequency f_x can be obtained by using the power supply frequency f_{line} (commercial power supply frequency) and the pole number p . If, therefore, it is possible to measure the actual rotation frequency f_r of the three-phase induction motor, a sideband wave originating from the pole passing frequency f_{pp} in a current spectrum can be specified. This makes it possible to clarify the accurate magnitude of the sideband wave and

obtain an accurate deterioration parameter. If, however, the actual rotation frequency f_r of the three-phase induction motor is not clear, an estimated value (for example, a previously measured value or a value written in specifications) is used. That is, an accurate deterioration parameter cannot be obtained, and hence there is a problem that it is not possible to properly diagnose the state of the rotary mechanical system.

[0006] The present invention has been made in consideration of the above situation, and has as its object to provide a method for determining the characteristic feature quantity of a three-phase induction motor which is required to calculate a deterioration parameter when diagnosing the state of a rotary mechanical system using the three-phase induction motor as a drive source by using a deterioration parameter obtained by analysis of a current signal in operation from the three-phase induction motor.

Solution to Problem

[0007] A method for determining the characteristic feature quantity of a three-phase induction motor according to the present invention aiming at the above object is a method for determining a characteristic feature quantity of a three-phase induction motor which is required to diagnose a state of a rotary mechanical system using the three-phase

induction motor as a drive source at an operation time, including a first process of measuring a current signal in operation of the three-phase induction motor and performing frequency analysis of the current signal in operation,

a second process of obtaining, from a current spectrum obtained by the frequency analysis, sideband waves of a power supply frequency spectrum of the three-phase induction motor as a sideband wave S_A and a sideband wave S_B by obtaining a peak having a maximum height and existing in a frequency domain A having a value of a difference between a power supply frequency f_{line} and a synchronous rotation frequency f_x of the three-phase induction motor as a lower limit frequency and a value obtained by adding, to the lower limit frequency, a frequency value set within a range of 0.01 Hz to 4 Hz, as an upper limit frequency, and obtaining a peak having a maximum height and existing in a frequency domain B having a value obtained by adding the synchronous rotation frequency f_x to the power supply frequency f_{line} as an upper limit frequency and a value obtained by subtracting, from the upper limit frequency, a frequency value set within the range of 0.01 Hz to 4 Hz, as a lower limit frequency,

and a third process of setting, as an actual rotation frequency f_r of the three-phase induction motor, an absolute

value of a difference between the power supply frequency f_{line} and the peak position frequency of one of the sideband waves S_A and S_B ,

wherein the actual rotation frequency f_r is determined as a first characteristic feature quantity.

Advantageous Effects of Invention

[0008] In the method for determining the characteristic feature quantity of the three-phase induction motor according to the present invention, since the actual rotation frequency f_r of the three-phase induction motor is determined from a current signal in operation measured when the state of the rotary mechanical system at the time of an operation is diagnosed and is set as the first characteristic feature quantity of the three-phase induction motor, the determined actual rotation frequency f_r accurately reflects the rotation state of the three-phase induction motor at the time of a diagnosis. For this reason, configuration of a deterioration parameter for judging the state of the rotary mechanical system at the time of an operation by using the actual rotation frequency f_r can accurately evaluate the state of the three-phase induction motor by using the deterioration parameter. This can improve the accuracy of the state diagnosis of the rotary mechanical system.

The actual rotation frequency f_r of the three-phase induction motor is involved in the generation of sideband waves associated with the mechanical structure of the rotary mechanical system, and hence it is possible to accurately obtain a deterioration parameter reflecting the mechanical structure of the rotary mechanical system.

Brief Description of Drawings

[0009] Fig. 1 is a schematic view showing a power supply frequency spectrum and sideband waves of an actual rotation frequency which appear in the current spectrum of a current signal in operation from a three-phase induction motor;

Fig. 2 is a block diagram showing the arrangement of a device used in a method for determining the characteristic feature quantity of a three-phase induction motor according to an embodiment of the present invention;

Fig. 3 is a schematic view showing a power supply frequency spectrum and sideband waves of a rotor bar slip frequency which appear in the current spectrum of a current signal in operation from the three-phase induction motor; and

Fig. 4 is a schematic view showing a current spectrum obtained by frequency analysis of a current signal in operation from the three-phase induction motor.

Description of Embodiments

[0010] An embodiment of the present invention will be described below with reference to the accompanying drawings to provide an understanding of the invention.

A method for determining the characteristic feature quantity of a three-phase induction motor according to an embodiment of the present invention is a method for determining the characteristic feature quantity of a three-phase induction motor which is required to calculate a deterioration parameter when diagnosing the state of a rotary mechanical system using the three-phase induction motor as a drive source at the time of an operation by using the deterioration parameter obtained by analysis of a current signal in operation from the three-phase induction motor. This method will be described in detail below.

[0011] The method for determining the characteristic feature quantity of a three-phase induction motor includes a first process of measuring a current signal in operation from the three-phase induction motor, performing frequency analysis of the current signal in operation, and logarithmically transforming the value of the obtained current spectrum, a second process of obtaining, from the logarithmically transformed current spectrum, as shown in Fig. 1, sideband waves of a power supply frequency spectrum S_L of

the three-phase induction motor as a sideband wave S_A and a sideband wave S_B by obtaining a peak having a maximum height and existing in a frequency domain A having the value of the difference between a power supply frequency f_{line} and a synchronous rotation frequency f_x of the three-phase induction motor as a lower limit frequency and the value obtained by adding, to the lower limit frequency, a frequency value set within the range of 0.01 Hz to 4 Hz, for example, 2 Hz, as an upper limit frequency, and obtaining a peak having a maximum height and existing in a frequency domain B having the value obtained by adding the synchronous rotation frequency f_x to the power supply frequency f_{line} as an upper limit frequency and the value obtained by subtracting, from the upper limit frequency, a frequency value set within the range of 0.01 Hz to 4 Hz, for example, 2 Hz, as a lower limit frequency, and a third process of setting, as an actual rotation frequency f_r of the three-phase induction motor, the absolute value of the difference between the power supply frequency f_{line} and the peak position frequency of one of the sideband waves S_A and S_B , for example, one of the sideband waves S_A and S_B which has a higher peak height (a larger current power value), thereby setting the actual rotation frequency f_r as the first characteristic feature quantity of the three-phase induction

motor.

[0012] In the first process, as shown in Fig. 2, for example, a current signal in operation as an analog signal is detected by a noncontact clamp current sensor 14 with respect to an arbitrary one-phase wiring of motor wirings 13 of a three-phase induction motor 12 in an electric panel 11 of a rotary mechanical system 10. Note that when the electric panel 11 is placed near the rotary mechanical system 10, a current signal in operation can be detected by using a noncontact clamp current sensor with respect to an arbitrary one-phase cable of power cables 15 connected to the three-phase induction motor 12. The current signal in operation detected by the clamp current sensor 14 is input to an A/D converter 16 to be converted into a digital signal. The digital signal is input to a frequency analyzer 18, which performs fast Fourier transformation (an example of frequency analysis) via a transmission path 17. With this operation, the current spectrum of the current signal in operation can be obtained.

[0013] As shown in Fig. 2, a first data processing means 19 performs the second process upon receiving the spectrum data (data representing the relationship between frequency and current power value (peak height)) of the current spectrum of the current signal in operation output from the frequency

analyzer 18.

In the second process, first, the first data processing means 19 obtains the power supply frequency spectrum S_L of the three-phase induction motor 12 from the current spectrum. In this case, since the power supply frequency f_{line} is a commercial power supply frequency (50 Hz in the eastern area of Japan, and 60 Hz in the western area of Japan) at which power is supplied to the three-phase induction motor 12, the first data processing means 19 obtains, from the spectrum data of the current spectrum, spectrum data whose frequency value coincides with the commercial power supply frequency, and sets the current power value of the obtained spectrum data as the current power value of the power supply frequency spectrum S_L (end of processing 1).

[0014] Subsequently, when the pole number of the three-phase induction motor 12 is the pole number p , the synchronous rotation frequency f_x of the three-phase induction motor 12 is calculated as $f_x = 2f_{line}/p$, and hence the first data processing means 19 extracts spectrum data corresponding to a maximum current power value (a peak with a maximum height; the same applies hereinafter) in the current spectrum from the spectrum data existing in the frequency domain A having the value of a difference $f_{line} - f_x$ between the power supply

frequency f_{line} and the synchronous rotation frequency f_x of the three-phase induction motor 12, i.e., $f_{line} - 2f_{line}/p$, as a lower limit frequency and the value obtained by adding 2 Hz to the lower limit frequency, i.e., $f_{line} - 2f_{line}/p + 2$, as an upper limit frequency. The first data processing means 19 then respectively sets the frequency and current power value of the extracted spectrum data as the frequency and current power value of the sideband wave S_A (end of processing 2).

The first data processing means 19 also extracts spectrum data corresponding to a maximum current power value in the current spectrum from the spectrum data existing in the frequency domain B having a value $f_{line} + f_x$ obtained by adding the synchronous rotation frequency f_x to the power supply frequency f_{line} , i.e., $f_{line} + 2f_{line}/p$, as an upper limit frequency and the value obtained by subtracting 2 Hz from the upper limit frequency, i.e., $f_{line} + 2f_{line}/p - 2$, as a lower limit frequency. The first data processing means 19 then sets the frequency and current power value of the extracted spectrum data as the frequency and current power value of the sideband wave S_B (end of processing 3).

Note that the first data processing means 19 can be configured by, for example, installing programs for executing processing 1 to 3 in a personal computer. In this case, the

values of a commercial power supply frequency and the pole number p of the three-phase induction motor 12 are input to the first data processing means 19 in advance.

[0015] As shown in Fig. 2, a second data processing means 20 performs the third process upon receiving the data of the sideband wave S_A (the current power value of the sideband wave S_A and a frequency f_A corresponding to the current power value) and the data of the sideband wave S_B (the current power value of the sideband wave S_B and a frequency f_B corresponding to the current power value), which are output from the first data processing means 19.

In the third process, the second data processing means 20 specifies a sideband wave having a large current power value by comparing the current power value of the sideband wave S_A with that of the sideband wave S_B , and obtains a peak position frequency f_{Smax} of the specified sideband wave. An absolute value $|f_{Smax} - f_{line}|$ of the difference between the peak position frequency f_{Smax} and the power supply frequency f_{line} is set as the actual rotation frequency f_r of the three-phase induction motor 12. If, for example, when the current power value of the sideband wave S_A is larger than that of the sideband wave S_B , $f_r = f_{line} - f_A$, and when the current power value of the sideband wave S_B is larger than that of the sideband wave S_A ,

$f_r = f_B - f_{line}$. Note that the obtained actual rotation frequency f_r is output from the second data processing means 20 (processing 4).

In this case, the second data processing means 20 can be configured by, for example, installing programs for executing processing 4 in a personal computer.

[0016] A method for determining the characteristic feature quantity of a three-phase induction motor according to this embodiment includes a fourth process of setting the difference between the synchronous rotation frequency f_x and the actual rotation frequency f_r as a slip frequency f_s , a fifth process of obtaining, from a current spectrum, sideband waves of a power supply frequency spectrum, which are sideband waves S_{PA} (peak frequency position f_{PA}) and sideband waves S_{PB} (peak frequency position f_{PB}) originating from a pole passing frequency f_{pp} defined as the product of the slip frequency f_s and the pole number p of the three-phase induction motor 12 and respectively existing on the low frequency side and the high frequency side, a sixth process of obtaining a peak having a maximum height and existing between the sideband wave S_{PA} and the sideband wave S_A to set a sideband wave S_{LA} and obtaining a peak having a maximum height and existing between the sideband wave S_{PB} and the sideband wave S_B to set a sideband wave S_{LB} ,

a seventh process of setting the absolute value of the difference between the power supply frequency f_{line} and one of the sideband waves S_{LA} and S_{LB} , for example, a peak position frequency, of the sideband waves S_{LA} and S_{LB} , which has a higher peak height, as a rotor bar slip frequency f_{rs} of the three-phase induction motor 12, and an eighth process of dividing the rotor bar slip frequency f_{rs} by the slip frequency f_s to obtain a rotor bar count h of the three-phase induction motor 12, thereby setting the rotor bar count h as the second characteristic feature quantity of the three-phase induction motor 12.

[0017] As shown in Fig. 2, a third data processing means 21 performs the fourth to eighth processes upon receiving the spectrum data of the current spectrum of a current signal in operation obtained in the first process (output from the frequency analyzer 18), the data of the sideband waves S_{LA} and S_{LB} and the synchronous rotation frequency f_x of the three-phase induction motor 12 which are obtained in the second process (acquired from the first data processing means 19), and the actual rotation frequency f_r obtained in the third process (acquired from the second data processing means 20).

[0018] In the fourth process, the third data processing means 21 obtains a difference $f_x - f_r$ between the synchronous rotation frequency f_x and the actual rotation frequency f_r

respectively acquired from the first and second data processing units 19 and 20 to set the slip frequency f_s (processing 5).

In the fifth process, as shown in Fig. 3, the third data processing means 21 obtains the sideband wave S_{PA} (peak frequency position f_{PA}) and the sideband wave S_{PB} (peak frequency position f_{PB}) originating from the pole passing frequencies f_{pp} each defined as the product of the slip frequency f_s and the pole number p of the three-phase induction motor 12, i.e., existing at frequency positions respectively separated from the current spectrum peak of the power supply frequency f_{line} of the three-phase induction motor 12 as the center by the pole passing frequency f_{pp} to the low frequency side and the high frequency side. In the sixth process, the third data processing means 21 obtains a peak having a maximum height and existing between the sideband wave S_{PA} and the sideband wave S_A (i.e., extracts spectrum data corresponding to a maximum current power value from the spectrum data existing between the sideband wave S_{PA} and the sideband wave S_A) to set the frequency and current power value of the extracted spectrum data as a peak frequency f_{LA} and current power value of the sideband wave S_{LA} , and obtains a peak having a maximum height and existing between the sideband wave S_{PB} and the sideband wave S_B (i.e., extracts spectrum data corresponding to a maximum

current power value from the spectrum data existing between the sideband wave S_{PB} and the sideband wave S_B) to respectively set the frequency and current power value of the extracted spectrum data as a peak frequency f_{LB} and current power value of the sideband wave S_{LB} (processing 6).

[0019] In the seventh process, the third data processing means 21 compares the current power value of one of the sideband waves S_{LA} and S_{LB} , for example, the current power value of the sideband wave S_{LA} with that of the sideband wave S_{LB} to specify a sideband wave having a larger current power value, and obtains the peak position frequency of the specified sideband wave. The third data processing means 21 then sets the absolute value of the difference between the obtained peak position frequency and the power supply frequency f_{line} as the rotor bar slip frequency f_{rs} of the three-phase induction motor 12. If, for example, when the current power value of the sideband wave S_{LA} is larger than that of the sideband wave S_{LB} , $f_{rs} = f_{line} - f_{LA}$, and when the current power value of the sideband wave S_{LB} is larger than that of the sideband wave S_{LA} , $f_{rs} = f_{LB} - f_{line}$ (processing 7). In the eighth process, the third data processing means 21 divides the rotor bar slip frequency f_{rs} obtained in the seventh process by the slip frequency $f_s (= f_x - f_r)$ obtained in the fourth process, and sets an integer

value nearest the obtained value as the rotor bar count h of the three-phase induction motor 12 (processing 8).

In this case, the third data processing means 21 can be configured by, for example, installing programs for executing processing 5 to 8 in a personal computer.

[0020] As described above, it is possible to determine the actual rotation frequency f_r of the three-phase induction motor 12 and set the first characteristic feature quantity of the three-phase induction motor 12 by applying the method for determining the characteristic feature quantity of the three-phase induction motor according to the present invention to the current spectrum obtained by frequency analysis of a current signal in operation from the three-phase induction motor 12. This makes it possible to obtain the pole passing frequency f_{pp} ($= (f_x - f_r)p$) by using the actual rotation frequency f_r , the synchronous rotation frequency f_x of the three-phase induction motor 12, and the pole number p of the three-phase induction motor 12 and to specify a sideband wave of the pole passing frequency f_{pp} from the current spectrum. This reveals an accurate magnitude (current power value) $20\log I_{pole}$ of the sideband wave of the pole passing frequency f_{pp} (in this case, I_{pole} represents the current power value of the sideband wave originating from the pole passing frequency

f_{pp} obtained by fast Fourier transformation of the current signal in operation from the three-phase induction motor 12). For example, using $20\log I_{line} - 20\log I_{pole}$, i.e., $20\log(I_{line}/I_{pole})$, generated by using the magnitude $20\log I_{pole}$ of the sideband wave of the pole passing frequency f_{pp} and the magnitude $20\log I_{line}$ of the spectrum of the power supply frequency f_{line} (in this case, I_{line} represents the current power value of the current spectrum of the power supply frequency obtained by fast Fourier transformation of a current signal in operation from the three-phase induction motor 12) as a deterioration parameter makes it possible to accurately diagnose, from changes in the deterioration parameter, whether a rotor bar of the three-phase induction motor 12 has been damaged.

[0021] It is also possible to determine the rotor bar count h of the three-phase induction motor 12 and set the count as the second characteristic feature quantity of the three-phase induction motor 12 by applying the method for determining the characteristic feature quantity of the three-phase induction motor according to the present invention to the current spectrum of a current signal in operation from the three-phase induction motor 12. As a consequence, the rotor bar slip frequency f_{rs} ($= (f_x - f_r)h$) can be obtained by using the rotor

bar count h , the actual rotation frequency f_r , and the synchronous rotation frequency f_x of the three-phase induction motor 12. It is also possible to specify a sideband wave originating from the rotor bar slip frequency f_{rs} , which is a sideband wave of the power supply frequency spectrum, from the current spectrum. This makes it possible to know the accurate magnitude $20\log I_{rs}$ of the sideband wave originating from the rotor bar slip frequency f_{rs} (I_{rs} represents the current power value of the sideband wave originating from the rotor bar slip frequency f_{rs} obtained by fast Fourier transformation of a current signal in operation from the three-phase induction motor 12). Accordingly, for example, setting $20\log I_{line} - 20\log I_{rs}$, i.e., $20\log(I_{line}/I_{rs})$, generated by using the magnitude $20\log I_{rs}$ of the sideband wave originating from the rotor bar slip frequency f_{rs} and magnitude I_{line} of the spectrum of the power supply frequency f_{line} as a deterioration parameter makes it possible to accurately diagnose, from changes in the deterioration parameter, whether the load torque of the three-phase induction motor 12 has changed.

[0022] The present invention has been described above with reference to the embodiment. However, the present invention is not limited to any of the arrangements described in any of the above embodiments, and includes other embodiments and

modifications conceivable within the range of matters described in the scope of the claims. In addition, the present invention also includes combinations of constituent elements included in this embodiment and other embodiments and modifications.

For example, although the power supply frequency f_{line} of the power supply frequency spectrum of a current spectrum is the fundamental frequency of the power supply for supplying AC power to the three-phase induction motor, the power supply frequency f_{line} of the power supply frequency spectrum can be a harmonic frequency. This makes it possible to detect sideband waves and accurately evaluate a deterioration parameter associated with the mechanical structure of the rotary mechanical system even when the frequency of the sideband wave associated with the mechanical structure of the rotary mechanical system exceeds the fundamental frequency of the power supply.

Note that the present invention can be applied to even a case in which a power supply for supplying AC power to the three-phase induction motor is an inverter power supply.

Industrial Applicability

[0023] According to the present invention, when the state of a rotary mechanical system using a three-phase induction

motor as a drive source at the time of an operation is diagnosed, the actual rotation frequency f_r is determined from a current signal in operation and set as the characteristic feature quantity of the three-phase induction motor. The determined actual rotation frequency f_r accurately reflects the rotation state of the three-phase induction motor at the time of a diagnosis, and hence an accurate deterioration parameter can be obtained by using the actual rotation frequency f_r . Using this deterioration parameter can accurately evaluate the state of the three-phase induction motor. This makes it possible to perform a state diagnosis with respect to a rotary mechanical system existing in a remote place or installed in an inaccessible place. In addition, it is possible to improve the accuracy of a state diagnosis.

Reference Signs List

[0024] 10: Rotary mechanical system, 11: Electric panel, 12: Three-phase induction motor, 13: Electric motor wiring, 14: Clamp current sensor, 15: Power cable, 16: A/D converter, 17: Transmission path, 18: Frequency analyzer, 19: First data processing means, 20: Second data processing means, 21: Third data processing means

CLAIMS

1. A method for determining a characteristic feature quantity of a three-phase induction motor which is required to diagnose a state of a rotary mechanical system using the three-phase induction motor as a drive source at an operation time, characterized by comprising:

a first process of measuring a current signal in operation of the three-phase induction motor and performing frequency analysis of the current signal in operation;

a second process of obtaining, from a current spectrum obtained by the frequency analysis, sideband waves of a power supply frequency spectrum of the three-phase induction motor as a sideband wave S_A and a sideband wave S_B by obtaining a peak having a maximum height and existing in a frequency domain A having a value of a difference between a power supply frequency f_{line} and a synchronous rotation frequency f_x of the three-phase induction motor as a lower limit frequency and a value obtained by adding, to the lower limit frequency, a frequency value set within a range of 0.01 Hz to 4 Hz, as an upper limit frequency, and obtaining a peak having a maximum height and existing in a frequency domain B having a value obtained by adding the synchronous rotation frequency f_x to the power supply frequency f_{line} as an upper limit frequency and a value obtained by

subtracting, from the upper limit frequency, a frequency value set within the range of 0.01 Hz to 4 Hz, as a lower limit frequency; and

a third process of setting, as an actual rotation frequency f_r of the three-phase induction motor, an absolute value of a difference between the power supply frequency f_{line} and the peak position frequency of one of the sideband waves S_A and S_B ,

wherein the actual rotation frequency f_r is determined as a first characteristic feature quantity.

2. The method for determining the characteristic feature quantity of the three-phase induction motor according to claim 1, characterized by further comprising:

a fourth process of setting a difference between the synchronous rotation frequency f_x and the actual rotation frequency f_r as a slip frequency f_s ;

a fifth process of obtaining, from the current spectrum, sideband waves of the power supply frequency spectrum, which are sideband waves S_{PA} and S_{PB} originating from a pole passing frequency f_{pp} defined as a product of the slip frequency f_s and a pole number p of the three-phase induction motor and respectively existing on a low frequency side and a high frequency side;

a sixth process of obtaining a peak having a maximum height and existing between the sideband wave S_{PA} and the sideband wave S_A to set a sideband wave S_{LA} and obtaining a peak having a maximum height and existing between the sideband wave S_{PB} and the sideband wave S_B to set a sideband wave S_{LB} ;

a seventh process of setting an absolute value of a difference between the power supply frequency f_{line} and a peak position frequency of one of the sideband waves S_{LA} and S_{LB} , as a rotor bar slip frequency f_{rs} of the three-phase induction motor; and

an eighth process of dividing the rotor bar slip frequency f_{rs} by the slip frequency f_s to obtain a rotor bar count of the three-phase induction motor,

wherein the rotor bar count is set as a second characteristic feature quantity.

3. The method for determining the characteristic feature quantity of the three-phase induction motor according to claim 1 or 2, characterized in that the frequency domain A has a value obtained by adding 2 Hz to a lower limit frequency of the frequency domain A as an upper limit frequency of the frequency domain A, and the frequency domain B has a value obtained by subtracting 2 Hz from an upper limit frequency of the frequency domain B as a lower limit frequency of the frequency domain

B.