superimposed on fundamental wave>

The present inventors calculated the electromagnetic force F when an excitation current whose time waveform is the fundamental wave is supplied to the stator coil 122, and the electromagnetic force F when an excitation current whose time waveform is one obtained by superimposing various harmonics on the fundamental wave is supplied to the stator coil 122, by performing the electromagnetic field analysis (numerical analysis). Here, an excitation current I (ωt) [A] is assumed to be expressed by the following equation (5). In the equation (5), ω is an angular frequency [rad/s]. t is a time point [s]. n is an order [-] of a harmonic. $I_0$ is an amplitude [A] of the fundamental wave. $I_n$ is an amplitude [A] of an n-th harmonic. $\varphi_n$ is a phase difference [rad] between the fundamental wave and the n-th harmonic. Note that a symbol indicated within [] expresses a unit. Further, [-] indicates a dimensionless quantity. Further, it is assumed that when the phase difference $\varphi_n$ between the fundamental wave and the n-th harmonic is a positive value, the n-th harmonic has a leading phase with respect to the fundamental wave.

[0028] [Mathematical equation 2]

$$I(\omega t) = I_0 \sin\omega t + \sum_{n=2}^{\infty} I_n \sin(n\omega t + \phi_n) \quad \cdots (5)$$

is one obtained by superimposing the harmonic on the fundamental wave to be the same, corresponds to making the torques T of the motor M to be the same (namely, making the electromagnetic forces in a rotational direction of the motor M to be the same). Therefore, the difference in the electromagnetic forces F calculated under the condition where the effective values of the excitation currents are set to be the same as described above, is expressed as a difference in the electromagnetic forces in the radial direction of the motor M. Note that the electromagnetic force in the radial direction of the motor M is a component in the radial direction of the motor M, out of components of the electromagnetic force being the vector quantity. The component in the radial direction of the motor M is, for example, the r component of the two-dimensional polar coordinate system illustrated in Fig. 1.

[0032] Further, a reduction in the electromagnetic force F calculated as above corresponds to a reduction in an average value of a time waveform of a vibration of the motor M. In this examination, the reduction in the vibration of the motor M means the reduction in the average value of the time waveform of the vibration of the motor M.

[0033] Incidentally, if the harmonics of plurality of orders are superimposed on the fundamental wave or an extremely high-order harmonic is superimposed on the fundamental wave, a shape of the time waveform of

CPU 601.

[0076] The communication circuit 604 is a circuit for performing communication with the outside of the processing device 400. The communication circuit 604 may perform wireless communication or wire communication with the outside of the processing device 400.

[0077] The signal processing circuit 605 performs various kinds of signal processing on a signal received by the communication circuit 604 or a signal input in accordance with the control by the CPU 601.

The image processing circuit 606 performs various kinds image processing on a signal input in accordance with the control by the CPU 601. The signal after being subjected to this image processing is output to the display 609, for example.

The user interface 608 is a part with which an operator OP issues instructions to the processing device 400. The user interface 608 includes, for example, a button, a switch, a dial, and the like. Further, the user interface 608 may include a graphical user interface that uses the display 609.

[0078] The display 609 displays an image based on the signal output from the image processing circuit 606. The I/F circuit 607 exchanges data with a device connected to the I/F circuit 607. In Fig. 6, the user interface 608 and the display 609 are indicated as the devices connected to the I/F circuit 607. However, the device connected to the I/F