[DESCRIPTION]

[Title of Invention] EXTERNAL FIELD RESPONSE DISTRIBUTION VISUALIZATION DEVICE AND EXTERNAL FIELD RESPONSE DISTRIBUTION VISUALIZATION METHOD

[Technical Field]
[0001]
The present disclosure relates to an external field response distribution visualization device and the like that generates an image showing an external field response distribution.

[Background Art]
[0002]
Patent Literature (PTL) 1 discloses a device that obtains a field by measurement. The device obtains a magnetic force image of a distribution of magnetic force in a first measurement plane above a sample, obtains an auxiliary magnetic force image by performing measurement in a second measurement plane, which is a minute distance d away from the first measurement plane, and then obtains a magnetic force gradient image by dividing the difference between them by the minute distance d. The magnetic force image and the auxiliary magnetic force image are Fourier transformed and substituted into a three-dimensional field obtaining equation derived from a general solution of the Laplace equation to obtain the three-dimensional field indicating the magnetic force.
[0003]
The device disclosed in PTL 1 can obtain the state of the magnetic domains at the surface of the sample with high accuracy by obtaining the three-dimensional field.

[Citation List]
[Patent Literature]
[0004]
[PTL 1] WO 2008/123432
[Summary of Invention]
[Technical Problem]
[0005]
However, the device disclosed in PTL 1 is only capable of obtaining the magnetic domains at the surface of a sample. It is difficult to obtain the state of the magnetic domains at depths deeper than the surface of the sample. Stated differently, it is difficult to obtain the magnetic susceptibility distribution (i.e., the external field response distribution) of the interior of the sample.
[0006]
In view of this, embodiments of the present disclosure provide an external field response distribution visualization device and the like that can generate an image showing the external field response

distribution of an area including the interior of an object with high accuracy.

[Solution to Problem]
[0007]
According to a first aspect of the present disclosure, there is provided an external field response distribution visualization device that generates an image showing an external field response distribution, which is a distribution of responses to an external field, including: an induction circuit that induces a first field component from each of induction positions defined outside of an object as positions relative to the object; a sensor that senses, at each of sensing positions defined outside of the object as positions relative to the object, a strength of a field including a second field component induced from the object by the first field component, to sense the strength of the field at the sensing positions for each of the induction positions; and an information processing circuit that obtains a sensing result of the strength of the field and generates the image showing the external field response distribution of an area including an interior of the object based on the sensing result. The information processing circuit: calculates an induction position dependent field function that takes a virtual induction position and a virtual sensing position as inputs and outputs a strength of the field at the virtual sensing position, using the sensing result as a boundary condition; calculates an imaging function that takes an imaging target position as an input and outputs an image intensity at the imaging target position, and is defined based on a strength output from the induction position dependent field function in response to inputting the imaging target position, as the virtual induction position and the virtual sensing position, into the induction position dependent field function; and generates the image based on the imaging function.
[0007a]
According to a second aspect of the present disclosure, there is provided an external field response distribution visualization method of generating an image showing an external field response distribution, which is a distribution of responses to an external field, the external field response distribution visualization method including: inducing, by an induction circuit, a first field component from each of induction positions defined outside of an object as positions relative to the object; sensing, by a sensor, at each of sensing positions defined outside of the object as positions relative to the object, a strength of a field including a second field component induced from the object by the first field component, to sense the strength of the field at the sensing positions for each of the induction positions; and obtaining a sensing result of the strength of the field and generating the image showing the external field response distribution of an area including an interior of the object based on the sensing result, wherein the obtaining and generating includes: calculating an induction position dependent field

function that takes a virtual induction position and a virtual sensing position as inputs and outputs a strength of the field at the virtual sensing position, using the sensing result as a boundary condition; calculating an imaging function that takes an imaging target position as an input and outputs an image intensity at the imaging target position, and is defined based on a strength output from the induction position dependent field function in response to inputting the imaging target position, as the virtual induction position and the virtual sensing position, into the induction position dependent field function; and generating the image based on the imaging function.

[0008]

These general or specific aspects may be implemented as a system, a device or apparatus, a method, an integrated circuit, a computer program, or a non-transitory computer-readable recording medium such a CD-ROM, or any combination thereof.

[Advantageous Effects of Invention]

[0009]

According to embdoiments of the present disclosure, it is possible to generate an image showing the external field response distribution in an area including the interior of an object with high accuracy.

[Brief Description of Drawings]

[0010]

[FIG. 1]

FIG. 1 is a configuration diagram of a first example of a magnetic susceptibility distribution visualization device according to an embodiment of the present disclosure.

[FIG. 2]

FIG. 2 is a schematic diagram illustrating the reconstruction of a magnetic field according to a reference example.

[FIG. 3]

FIG. 3 is a schematic diagram illustrating the induction position and the sensing position according to an embodiment of the present disclosure.

[FIG. 4]

FIG. 4 is a schematic diagram illustrating another example of the induction position and the sensing position according to an embodiment of the present disclosure.

[FIG. 5]

FIG. 5 is a schematic diagram illustrating yet another example of the induction position and the sensing position according to an embodiment of the present disclosure.