[DESCRIPTION]

[Title of Invention] IMAGING DEVICE AND IMAGING METHOD

[Technical Field]
[0001]
The present disclosure relates to an imaging device, etc., that images an object in a measurement area using measurement data of scattered waves.

[Background Art]
[0002]
As techniques related to an imaging device or the like for imaging an object in a measurement area using measurement data of scattered waves, there are techniques described in Patent Literatures (PTLs) 1 to 5.
[0003]
For example, according to the technique described in PTL 1, beams sent out from a microwave sender are incident on an object to be inspected, and the amplitudes and phases of scattered beams are detected by a microwave detector. Then, the distribution of dielectric constants is calculated from output signals output from the microwave detector to display a tomogram of the object to be inspected.

[Citation List]

[Patent Literature]
[0004]
[PTL 1] Japanese Unexamined Patent Application Publication No. S62-66145
[PTL 2] WO 2014/125815
[PTL 3] WO 2015/136936
[PTL 4] WO 2021/020387
[PTL 5] WO 2021/053971

[Summary of Invention]
[Technical Problem]
[0005]
However, it is not easy to image an object in a measurement area using measurement data of scattered waves. More specifically, obtaining data on scattered waves radiated from a measurement area in relation to waves that are incident on the measurement area when the condition in the measurement area is known is called a forward problem and easy. On the other hand, obtaining the condition in an area when data on scattered waves is known is called an inverse problem and not easy.

[0006]

Transmitting a wave to a distant object and receiving a scattered wave from the distant object is difficult. Therefore, imaging a distant object in a wide measurement area with high accuracy is not easy.

[0007]

In view of this, embodiments of the present disclosure provide an imaging device or the like that is capable of imaging a distant object in a wide measurement area with high accuracy.

[Solution to Problem]

[0008]

According to a first aspect of the present disclosure, there is provided an imaging device including: a plurality of transmitters each of which includes a transmission area and transmits a wave from the transmission area to a measurement area; a plurality of receivers each of which includes a reception area and receives, in the reception area, a scattered wave of the wave from the measurement area; and an information processing circuit that images an object in the measurement area using measurement data of the scattered wave. Each of the transmission area and the reception area has a finite size. The information processing circuit: derives, using the measurement data, a scattering field function that receives a transmission position of the wave and a reception position of the scattered wave as input and outputs an amount of the scattered wave at the reception position, the finite size being reflected in the scattering field function; derives an imaging function that receives an imaging target position as input and outputs an image intensity at the imaging target position, and is defined based on an amount output from the scattering field function in response to inputting the imaging target position into the scattering field function as the transmission position and the reception position; and images the object in the measurement area using the imaging function.

[0008a]

According to a second aspect of the present disclosure, there is provided an imaging method including: transmitting, by a plurality of transmitters each of which includes a transmission area, a wave from the transmission area of each of the plurality of transmitters to a measurement area; receiving, by a plurality of receivers each of which includes a reception area, a scattered wave of the wave from the measurement area, in the reception area of each of the plurality of receivers; and imaging an object in the measurement area using measurement data of the scattered wave, wherein each of the transmission area and the reception area has a finite size, and the imaging of the object in the measurement area includes: deriving, using the measurement data, a scattering field function that receives a transmission position of the wave and a reception position of the scattered wave as input and outputs an amount of the scattered wave

at the reception position, the finite size being reflected in the scattering field function; deriving an imaging function that receives an imaging target position as input and outputs an image intensity at the imaging target position, and is defined based on an amount output from the scattering field function in response to inputting the imaging target position into the scattering field function as the transmission position and the reception position; and imaging the object in the measurement area using the imaging function.

[0009]

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]

[0010]

According to embodiments of the present disclosure, it is possible to image a distant object in a wide measurement area with high accuracy.

[Brief Description of Drawings]

[0011]

[FIG. 1]

FIG. 1 is a conceptual diagram showing a one-dimensional multistatic array antenna.

[FIG. 2]

FIG. 2 is a conceptual diagram showing the relationship between a transmission point and a reception point.

[FIG. 3]

FIG. 3 is a conceptual diagram showing the coordinates of a transmission point and a reception point.

[FIG. 4]

FIG. 4 is a conceptual diagram showing the relationship between a transmission point and a reception point in a plane.

[FIG. 5]

FIG. 5 is a conceptual diagram showing the relationship between a transmission point and a reception point on a curved plane.

[FIG. 6]

FIG. 6 is a conceptual diagram showing an example of coordinates relating to a semi-two-dimensional array antenna.

[FIG. 7]

FIG. 7 is a conceptual diagram showing a