this disclosure, but rather to provide examples to aid understanding thereof. Illustrative examples are discussed in the Detailed Description, which provides further description. Advantages offered by various examples may be further understood by examining this specification.

[0005a] In an aspect, there is provided a system including: an optical sensor coupled with a medical device and configured to receive a plurality of acoustic beamforming signals corresponding to a plurality of acoustic beamforming pulses emitted from an ultrasound array; and a processor configured to ascertain a location of the optical sensor based on at least some of the plurality of acoustic beamforming signals received by the optical sensor.

[0005b] In another aspect, there is provided a system including: an optical sensor coupled with a medical device and configured to receive: a plurality of acoustic beamforming signals corresponding to a plurality of acoustic beamforming pulses emitted from an ultrasound array; and a plurality of acoustic signals from a surrounding insonified region; and a processor configured to: ascertain a location of the optical sensor based on at least some of the plurality of acoustic beamforming signals received by the optical sensor; and create an ultrasound image of at least a portion the surrounding insonified region adjacent the medical device based on at least some of the plurality of acoustic signals from the surrounding insonified region received by the optical sensor.

[0005c] In a further aspect, there is provided a system including: an optical sensor coupled with a needle and configured to receive a plurality of acoustic signals from a surrounding insonified region; and a processor configured to generate an image of at least a portion the surrounding insonified region adjacent the needle based on at least some of the plurality of acoustic signals from the surrounding insonified region received by the optical sensor.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] The accompanying drawings, which are incorporated into and constitute a part of this specification, illustrate one or more certain examples and, together with the description of the example, serve to explain the principles and implementations of the certain examples.

[0007] Figures 1, 2A, and 2B show example systems for transponder tracking and ultrasound image enhancement

[0008] Figure 3 is a graph illustrating a method of triangulation in one example; and

[0009] Figures 4A, 4B, and 4C provide examples of fiber sensors detecting acoustic signals as a point sensor or a line sensor.

[0010] Figures 5 and 6 show example methods for transponder tracking and ultrasound image enhancement.

[0011] Figure 7 depicts a flow chart of an embodiment of a method for enhancing an ultrasound image using a point sensor or a line sensor.

DETAILED DESCRIPTION

[0012] Examples are described herein in the context of transponder tracking and ultrasound image enhancement. Those of ordinary skill in the art will realize that the following description is illustrative only and is not intended to be in any way limiting. Reference will now be made in detail to implementations of examples as illustrated in the accompanying drawings. The same reference indicators will be used throughout the drawings and the following description to refer to the same or like items.

[0013] In the interest of clarity, not all of the routine features of the examples described herein are shown and described. It will, of course, be appreciated that in the development of any such actual implementation, numerous implementation-specific decisions can be made in order to achieve the developer's specific goals, such as compliance with application- and business-related constraints, and that these specific goals will vary from one implementation to another and from one developer to another

CLAIMS

1. A system comprising:

an optical sensor coupled with a medical device and configured to receive a plurality of acoustic beamforming signals corresponding to a plurality of acoustic beamforming pulses emitted from an ultrasound array; and

a processor configured to ascertain a location of the optical sensor based on at least some of the plurality of acoustic beamforming signals received by the optical sensor.

2. The system of claim 1, wherein:

the optical sensor is configured to receive a plurality of acoustic signals from a surrounding insonified region; and

the processor is configured to create an ultrasound image of at least a portion the surrounding insonified region adjacent the medical device based on at least some of the plurality of acoustic signals from the surrounding insonified region received by the optical sensor.

3. The system of claim 1, wherein the optical sensor comprises a fiber optical sensor.

4. The system of claim 1, wherein the optical sensor is configured to optically sense a deformation of a material of the optical sensor caused by the acoustic beamforming signals incident on the optical sensor.

5. The system of claim 1, wherein the optical sensor is configured to detect a polarization change in light guided in the optical sensor as the acoustic beamforming signals are incident on the optical sensor.

6. A system comprising:

an optical sensor coupled with a medical device and configured to receive:

a plurality of acoustic beamforming signals corresponding to a plurality of acoustic beamforming pulses emitted from an ultrasound array; and

a plurality of acoustic signals from a surrounding insonified region; and

a processor configured to:

ascertain a location of the optical sensor based on at least some of the plurality of acoustic beamforming signals received by the optical sensor; and

create an ultrasound image of at least a portion the surrounding insonified region adjacent the medical device based on at least some of the plurality of acoustic signals from the surrounding insonified region received by the optical sensor.

7. The system of claim 6, wherein the processor is configured to present the location of the optical sensor and the ultrasound image in real time.

8. The system of claim 6, wherein the ultrasound image of at least the portion of the surround insonified region is combined with an image generated by the ultrasound array.

9. The system of claim 6, wherein the optical sensor comprises a fiber sensor.

10. A system comprising:

an optical sensor coupled with a needle and configured to receive a plurality of acoustic signals from a surrounding insonified region; and

a processor configured to generate an image of at least a portion the surrounding insonified region adjacent the needle based on at least some of the plurality of acoustic signals from the surrounding insonified region received by the optical sensor.

11. The system of claim 10, wherein:

the optical sensor is configured to receive a plurality of acoustic beamforming signals corresponding to a plurality of acoustic beamforming pulses emitted from an ultrasound array; and

the processor is configured to ascertain the location of the optical sensor based on at least some of the plurality of acoustic beamforming signals received by the optical sensor.

12. The system of claim 10, wherein the optical sensor is coupled with the needle at a distal portion of the needle.

13. The system of claim 10, wherein the optical sensor is arranged on the needle for a diagnostic or therapeutic procedure.

14. The system of claim 10, wherein the image of at least a portion of the surrounding insonified region is generated in real time.

15. The system of claim 10, wherein the optical sensor is arranged to detect a change in polarization of light in response to the plurality of acoustic signals.

16. The system of claim 10, wherein the optical sensor is configured to optically sense a deformation of a material of the optical sensor caused by the acoustic beamforming signals incident on the optical sensor.

17. The system of claim 10, wherein the optical sensor is arranged to amplify light matter interactions.