CLAIMS

1. A system comprising:

a component (56) configured for movement;

a sensor (34) comprising a transducer (112) for transmitting an ultrasonic signal (122) through a fluid medium (120) toward a surface of the component; and

ranging logic (36) configured to determine the velocity of the ultrasonic signal through the fluid as a function of the temperature and pressure of the fluid, determine a propagation time of the ultrasonic signal from the sensor to the surface of the component, and determine the distance traveled by the ultrasonic signal as it propagates from the sensor to the surface of the component based upon the velocity and the propagation time, wherein the determined distance corresponds to the position of the component (56) relative to the position of the sensor.

2. The system of claim 1, comprising a temperature sensing device (114) that provides the temperature to the ranging logic.

3. The system of claim 2, wherein the temperature sensing device comprises a resistance temperature detector (RTD) embedded in the transducer.

4. The system of claim 1, wherein the pressure of the fluid is provided to the ranging logic as an expected pressure value or as a measured pressure value provided by a pressure sensing device.

5. The system of claim 1, wherein the propagation time from the sensor to the surface of the component is determined based upon a total transit time along a signal path between the ranging logic and the surface of the component subtracted by a delay time introduced into the signal path by non-fluid components.

6. The system of claim 5, wherein the non-fluid components comprise wiring (38) coupling the sensor to the ranging logic and a sensor window (116) through which the ultrasonic signal is transmitted.

7. The system of claim 1, wherein the component is configured to move linearly, and wherein the distance determined by the ranging logic corresponds to a linear position of the component relative to the position of the sensor.

8. A method comprising:

transmitting an ultrasonic signal (122) into a fluid medium (120) toward a device (56) using a transducer (112) of a sensor (34) disposed in an oilfield component (40), wherein the ultrasonic signal is transmitted through a window (116) of the sensor into the fluid medium (120), and wherein the device is configured for movement within the oilfield component;

determining the velocity of the ultrasonic signal through the fluid medium as a function of the temperature and pressure of the fluid medium;

determining the transit time required for the ultrasonic signal to propagate from the sensor to the device;

using the velocity and the transit time to determine a path length (156) that the ultrasonic signal travels to reach the device; and

using the determined path length to identify the location of the device in the oilfield component relative to the location of the sensor.

9. The method of claim 8, wherein determining the transit time comprises determining a first time required for the ultrasonic signal to propagate from the transducer to the device and reducing the first time by a second time corresponding to a delay time introduced by the window through which the ultrasonic signal is transmitted.

10. The method of claim 9, wherein the device is configured to move to a desired position within the oilfield component in response to a control input, and wherein the method comprises indicating an alarm condition if the device fails to move to the desired position in response to the control input.

CLAIMS

1. A system comprising:

a component configured for movement;

a sensor comprising a transducer for transmitting an ultrasonic signal through a fluid medium toward a surface of the component; and

ranging logic configured to determine the velocity of the ultrasonic signal through the fluid as a function of the temperature and pressure of the fluid, determine a propagation time of the ultrasonic signal from the sensor to the surface of the component, and determine the distance traveled by the ultrasonic signal as it propagates from the sensor to the surface of the component based upon the velocity and the propagation time, wherein the determined distance corresponds to the position of the component relative to the position of the sensor.

2. The system of claim 1, comprising a temperature sensing device that provides the temperature to the ranging logic.

3. The system of claim 2, wherein the temperature sensing device comprises a resistance temperature detector (RTD) embedded in the transducer.

4. The system of claim 1, wherein the pressure of the fluid is provided to the ranging logic as an expected pressure value or as a measured pressure value provided by a pressure sensing device.

5. The system of claim 1, wherein the propagation time from the sensor to the surface of the component is determined based upon a total transit time along a signal path between the ranging logic and the surface of the component subtracted by a delay time introduced into the signal path by non-fluid components.

6. The system of claim 5, wherein the non-fluid components comprise wiring coupling the sensor to the ranging logic and a sensor window through which the ultrasonic signal is transmitted.

7. The system of claim 1, wherein the component is configured to move linearly, and wherein the distance determined by the ranging logic corresponds to a linear position of the component relative to the position of the sensor.

8. A system comprising:

a subsea device having a component configured to move in response to a control input; and

a position sensing system including processing logic and a position sensor, wherein the position sensing system determines the position of the component by using the processing logic to compute the velocity of an ultrasonic pulse transmitted from the position sensor toward a surface of the component as a function of the temperature and pressure of a fluid medium disposed between the sensor and the component, compute the travel time of the ultrasonic pulse from the position sensor to the surface of the component, and compute the distance traveled by the ultrasonic pulse from the sensor to the surface of the component;

wherein the computed distance indicates the location of the component relative to the location of the position sensor.

9. The system of claim 8, wherein the subsea device comprises a blowout preventer and the component comprises a piston of the blowout preventer, wherein the blowout preventer comprises a body and an actuator assembly coupled to the body, and wherein the actuator assembly comprises a head and a cylinder in which the piston is disposed, the piston being configured to move within the cylinder in a linear direction either away from or toward the head to reach an expected position in response to a hydraulic control input.

10. The system of claim 9, wherein the processing logic is configured to indicate an alarm condition if the piston fails to reach the expected position in response to the hydraulic control input.

11. The system of claim 9, wherein an inner surface of the head comprises a recess configured to receive the position sensor.

12. The system of claim 11, wherein the position sensor comprises a housing, a temperature detection device, and a transducer configured to generate the ultrasonic pulse.

13. The system of claim 12, wherein the transducer comprises a casing, a window through which the ultrasonic pulse is transmitted toward the surface of the piston, and a piezoelectric material, wherein the casing is configured to fit within the housing and the piezoelectric material is enclosed within the casing.

14. The system of claim 13, wherein the piezoelectric material comprises lead zirconate titanate.

15. The system of claim 13, wherein the window is formed from a material comprising a polyetherimide, organic polymer thermoplastic, or a polyimide-based plastic.

16. The system of claim 12, wherein the transducer generates the ultrasonic pulse at a frequency of between 200 kilohertz and 5 megahertz.

17. The system of claim 11, comprising an opening extending from the recess to an outer surface of the head for receiving wiring that communicatively couples the position sensor to the processing logic.

18. A method comprising:

transmitting an ultrasonic signal into a fluid medium toward a device using a transducer of a sensor disposed in an oilfield component, wherein the ultrasonic signal is transmitted through a window of the sensor into the fluid medium, and wherein the device is configured for movement within the oilfield component;

determining the velocity of the ultrasonic signal through the fluid medium as a function of the temperature and pressure of the fluid medium;

determining the transit time required for the ultrasonic signal to propagate from the sensor to the device;

using the velocity and the transit time to determine a path length that the ultrasonic signal travels to reach the device; and

using the determined path length to identify the location of the device in the oilfield component relative to the location of the sensor.

19. The method of claim 18, wherein determining the transit time comprises determining a first time required for the ultrasonic signal to propagate from the transducer to the device and reducing the first time by a second time corresponding to a delay time introduced by the window through which the ultrasonic signal is transmitted.

20. The method of claim 19, wherein the device is configured to move to a desired position within the oilfield component in response to a control input, and wherein the method comprises indicating an alarm condition if the device fails to move to the desired position in response to the control input.