

first and second different diffraction gratings in contact with the fluid;

at least one interrogation device providing ultrasound incident on the first and second diffraction gratings;

at least one detector for capturing first and second reflection spectra from the first and second diffraction gratings, respectively; and

a processing device receiving an output of the at least one detector for determining fluid properties based on the first and second reflection spectra.

**11.** The system of claim 10 wherein the fluid is a multiphase fluid.

**12.** The system of claim 11 wherein the fluid includes solids in a liquid and the processing device determines values corresponding to size and concentration of the solids in the liquid.

**13.** A method for determining a property of a multiphase fluid comprising:

interrogating at least one diffraction grating in contact with the multiphase fluid with ultrasound at an angle of incidence by passing the ultrasound through a member comprised of solid material and having the diffraction grating having a grating period formed on a face thereof,

receiving a response to the interrogating wherein the response includes a reflection spectrum of ultrasound reflected at a predetermined angle relative to the normal of the diffraction grating; and

determining a first value corresponding to a property of the multiphase fluid from the reflection spectrum.

**14.** The method of claim 13 wherein interrogating at least one diffraction grating includes interrogating first and second different diffraction gratings.

**15.** The method of claim 14 wherein the first and second diffraction gratings have a different diffraction period.

**16.** The method of claim 13 wherein the received response includes different diffraction orders.

**17.** The method of claim 16 wherein the received response includes diffraction orders between zero and three inclusive.

**18.** A method for determining a property of a multiphase fluid comprising:

providing a diffraction grating having a grating period formed on a member comprising solid material;

providing ultrasound through the member and incident on the diffraction grating at an angle of incidence;

capturing reflections from the diffraction grating while the diffraction grating is in contact with the fluid and the ultrasound is incident on the diffraction grating; and

determining a first property of the multiphase fluid from a first peak in the spectrum of the captured ultrasound.

**19.** The method of claim 18 further comprising capturing reflections from a second different diffraction grating.

**20.** The method of claim 18 further comprising determining a second property of the multiphase fluid from a second peak in the spectrum of the captured ultrasound.

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