CLAIMS

The invention claimed is:

1. A system, comprising:

a flow path containing a fluid;

a fluid separator coupled to the flow path and having an inlet for receiving the fluid and a discharge conduit for discharging the fluid after having undergone a separation process in the fluid separator;

an optical computing device having an integrated computational element configured to optically interact with the fluid before the fluid enters the fluid separator and after the fluid exits the fluid separator and thereby generate optically interacted light; and

at least one detector arranged to receive the optically interacted light and generate an output signal corresponding to a characteristic of the fluid.

2. The system of claim 1, further comprising an optical light pipe that communicably couples the optical computing device to the fluid at or near the inlet of the fluid separator.

3. The system of claim 2, wherein the optical light pipe conveys the optically interacted light from at or near the inlet to the optical computing device.

4. The system of claim 2, wherein the optical computing device further comprises an electromagnetic radiation source configured to emit electromagnetic radiation that optically interacts with the fluid.

5. The system of claim 4, wherein the optical light pipe conveys electromagnetic radiation from the electromagnetic radiation source to the fluid at or near the inlet.

6. The system of claim 1, wherein the optically interacted light comprises first and second beams of optically interacted light, the first beam of optically interacted light being conveyed to the optical computing device via the optical light pipe.

7. The system of claim 6, wherein the at least one detector time multiplexes the first and second beams of optically interacted light and the output signal comprises corresponding first and second output signals.

8. The system of claim 7, further comprising a signal processor communicably coupled to the at least one detector and configured to receive the first and second output signals and provide a resulting output signal.

9. The system of claim 8, wherein the resulting output signal is indicative of how the characteristic of the fluid changes between the inlet and the discharge conduit.

10. The system of claim 9, wherein the characteristic of the fluid is a concentration of a substance in the fluid.

11. The system of claim 10, wherein the substance is a hydrocarbon.

12. The system of claim 9, wherein the characteristic of the fluid is one or more chemicals or chemical compositions present in the fluid.

13. The system of claim 12, wherein the characteristic comprises a chemical or chemical composition selected from the group consisting of salts, precipitates, water, chemical tags, physical tags, metals, organic compounds, volatile organic compounds, additives, treatments, polymers, drugs, medicines, poisons, emulsion breakers, digester organisms, de-foaming agents, coalescing agents, flocculants, and any derivatives or combinations thereof.

14. The system of claim 9, wherein the characteristic of the fluid is a concentration of a biological organism.

15. The system of claim 8, further comprising an automated control system communicably coupled to the signal processor and configured to adjust one or more parameters of the fluid in response to the resulting output signal.

16. A method of determining a characteristic of a fluid, comprising:

containing a fluid within a flow path;

conveying the fluid to a fluid separator coupled to the flow path, the fluid separator having an inlet for receiving the fluid and a discharge conduit for discharging the fluid after having undergone a separation process in the fluid separator;

arranging at least one optical computing device on the fluid separator, the at least one optical computing device having at least one integrated computational element and at least one detector arranged therein;

optically interacting the at least one integrated computational element with the fluid at or near the inlet, thereby generating a first beam of optically interacted light corresponding to the characteristic of the fluid at or near the inlet;

optically interacting the at least one integrated computational element with the fluid at or near the discharge conduit, thereby generating a second

beam of optically interacted light corresponding to the characteristic of the fluid at or near the discharge conduit;

receiving the first and second beams of optically interacted light with the at least one detector; and

generating an output signal with the at least one detector, the output signal being indicative of how the characteristic of the fluid changes between the inlet and the discharge conduit.

17. The method of claim 16, wherein optically interacting the at least one integrated computational element with the fluid at or near the inlet further comprises conveying via an optical light pipe electromagnetic radiation from an electromagnetic radiation source, the optical light pipe communicably coupling the optical computing device to the fluid at or near the inlet.

18. The method of claim 16, wherein optically interacting the at least one integrated computational element with the fluid at or near the inlet further comprises conveying the first beam of optically interacted light to the at least one integrated computational element via an optical light pipe communicably coupling the optical computing device to the fluid at or near the inlet.

19. The method of claim 16, wherein the output signal comprises first and second output signals corresponding to the first and second beams of optically interacted light, the method further comprising:

receiving the first and second output signals with a signal processor communicably coupled to the at least one detector; and

generating a resulting output signal with the signal processor.

20. The method of claim 16, further comprising time multiplexing the first and second beams of optically interacted light with the at least one detector in order to generate the first and second output signals.

21. The method of claim 16, further comprising conveying the resulting output signal to a user for consideration.

22. The method of claim 16, further comprising undertaking at least one corrective step with an automated control system when a concentration of the characteristic of the fluid surpasses a predetermined range of suitable operation, the automated control system being communicably coupled to the signal processor.

23. The method of claim 16, further comprising conveying a warning signal to a user when a concentration of the characteristic of the fluid surpasses a predetermined range of suitable operation.

Claims:

1. A system, comprising:

   a flow path containing a fluid, the fluid including a desired characteristic;

   a fluid separator coupled to the flow path and having an inlet for receiving the fluid and a discharge conduit for discharging the fluid after having undergone a separation process in the fluid separator;

   an optical computing device having an integrated computational element configured to optically interact with electromagnetic radiation and the fluid before the fluid enters the fluid separator and after the fluid exits the fluid separator and thereby generate optically interacted light, the integrated computational element comprising a plurality of alternating layers of two materials having different index of refraction, the thickness of each layer and the number of layers being determined according to a spectral property of the electromagnetic radiation and a regression vector associated with the desired characteristic of the fluid, wherein a portion of the optically interacted light is transmitted through the integrated computational element; and

   at least one detector arranged to receive the optically interacted light and generate an output signal corresponding to the desired characteristic of the fluid.

2. The system of claim 1, further comprising an optical light pipe that communicably couples the optical computing device to the fluid at or near the inlet of the fluid separator.

3. The system of claim 2, wherein the optical light pipe conveys the optically interacted light from at or near the inlet to the optical computing device.

4. The system of claim 2, wherein the optical computing device further comprises an electromagnetic radiation source configured to emit the electromagnetic radiation that optically interacts with the fluid.

5. The system of claim 4, wherein the optical light pipe conveys electromagnetic radiation from the electromagnetic radiation source to the fluid at or near the inlet.

6. The system of claim 1, wherein the optically interacted light comprises first and second beams of optically interacted light, the first beam of optically interacted light being conveyed to the optical computing device via the optical light pipe.

7. The system of claim 6, wherein the at least one detector time multiplexes the first and second beams of optically interacted light and the output signal comprises corresponding first and second output signals.

8. The system of claim 7, further comprising a signal processor communicably coupled to the at least one detector and configured to receive the first and second output signals and provide a resulting output signal.

9. The system of claim 8, wherein the resulting output signal is indicative of how the desired characteristic of the fluid changes between the inlet and the discharge conduit.

10. The system of claim 9, wherein the desired characteristic of the fluid is a concentration of a substance in the fluid.

11. The system of claim 10, wherein the substance is a hydrocarbon.

12. The system of claim 9, wherein the desired characteristic of the fluid is one or more chemicals or chemical compositions present in the fluid.

13. The system of claim 12, wherein the desired characteristic comprises a chemical or chemical composition selected from the group consisting of salts, precipitates, water, chemical tags, physical tags, metals, organic compounds, volatile organic compounds, additives, treatments, polymers, drugs, medicines, poisons, emulsion breakers, digester organisms, de-foaming agents, coalescing agents, flocculants, and any derivatives or combinations thereof.

14. The system of claim 9, wherein the desired characteristic of the fluid is a concentration of a biological organism.

15. The system of claim 8, further comprising an automated control system communicably coupled to the signal processor and configured to adjust one or more parameters of the fluid in response to the resulting output signal.

16. A method of determining a desired characteristic of a fluid, comprising:
containing a fluid within a flow path;
conveying the fluid to a fluid separator coupled to the flow path, the fluid separator having an inlet for receiving the fluid and a discharge conduit for discharging the fluid after having undergone a separation process in the fluid separator;

arranging at least one optical computing device on the fluid separator, the at least one optical computing device having at least one integrated computational element and at least one detector arranged therein, and the at least one integrated computational element comprising a plurality of alternating layers of two materials having different index of refraction;

optically interacting the at least one integrated computational element with electromagnetic radiation and the fluid at or near the inlet, thereby generating a first beam of optically interacted light corresponding to the desired characteristic of the fluid at or near the inlet;

optically interacting the at least one integrated computational element with the electromagnetic radiation and the fluid at or near the discharge conduit, thereby generating a second beam of optically interacted light corresponding to the desired characteristic of the fluid at or near the discharge conduit, wherein the thickness of each layer and the number of layers in the integrated computational element are determined according to a spectral property of the electromagnetic radiation and a regression vector associated with the desired characteristic of the fluid, and wherein a portion of one of the first or second beams of optically interacted light is transmitted through the integrated computational element;

receiving the first and second beams of optically interacted light with the at least one detector; and

generating an output signal with the at least one detector, the output signal being indicative of how the desired characteristic of the fluid changes between the inlet and the discharge conduit.

17. The method of claim 16, wherein optically interacting the at least one integrated computational element with the fluid at or near the inlet further comprises conveying via an optical light pipe the electromagnetic radiation from an electromagnetic radiation source, the optical light pipe communicably coupling the optical computing device to the fluid at or near the inlet.

18. The method of claim 16, wherein optically interacting the at least one integrated computational element with the fluid at or near the inlet further comprises conveying the first beam of optically interacted light to the at least one integrated computational element via an optical light pipe communicably coupling the optical computing device to the fluid at or near the inlet.

19. The method of claim 16, wherein the output signal comprises first and second output signals corresponding to the first and second beams of optically interacted light, the method further comprising:

receiving the first and second output signals with a signal processor communicably coupled to the at least one detector; and

generating a resulting output signal with the signal processor.

20. The method of claim 16, further comprising time multiplexing the first and second beams of optically interacted light with the at least one detector in order to generate the first and second output signals.

21. The method of claim 16, further comprising conveying the resulting output signal to a user for consideration.

22. The method of claim 16, further comprising undertaking at least one corrective step with an automated control system when a concentration of the desired characteristic of the fluid surpasses a predetermined range of suitable operation, the automated control system being communicably coupled to the signal processor.

23. The method of claim 16, further comprising conveying a warning signal to a user when a concentration of the desired characteristic of the fluid surpasses a predetermined range of suitable operation.