Claims

1. A sensor for measuring the surface of a measurement object relative to the sensor, comprising:

a light source configured to emit measurement light;

a first Fabry-Pérot filter configured to filter the measurement light such that all mutually parallel light is of the same wavelength or combination of wavelengths;

first optics configured to focus measurement light exiting the first Fabry-Pérot filter onto a measurement plane, wherein the measurement light has a unique wavelength or combination of wavelengths at each point of focus of said measurement light along an axis in the measurement plane;

second optics configured to receive measurement light reflected from the surface of a measurement object and to direct said measurement light onto a second Fabry-Perot filter;

a sensor lens configured to focus measurement light exiting the second Fabre-Pérot filter onto a sensor plane; and,

a light sensor in the sensor plane configured to measure measurement light exiting the second Fabry-Pérot filter.

2. The sensor of claim 1, wherein:

an illumination axis extends from the light source to the measurement plane;

a measurement axis extends from the measurement plane to the light sensor;

the first Fabry-Pérot filter is positioned relative to the illumination axis at a first Fabry-Pérot filter tilt angle defined between the illumination axis and a normal vector of the first Fabry-Pérot filter; and

the second Fabry-Pérot filter is positioned relative to the measurement axis at a second Fabry-Pérot filter tilt angle defined between the measurement axis and a normal vector of the second Fabry-Pérot filter.

3. The sensor of claim 2 wherein a direction of rotation of the first Fabry-Pérot filter tilt angle is opposite to a direction of rotation of the second Fabry-Pérot filter tilt angle.

4. The sensor of claim 2 wherein a direction of rotation of the first Fabry-Pérot filter tilt angle is the same as a direction of rotation of the second Fabry-Pérot filter tilt angle.

5. The sensor of claim 3 wherein the first optics and second optics are mirror symmetric about a plane of symmetry parallel to and aligned with the measurement plane, and wherein the first Fabry-Pérot filter angle and second Fabry-Pérot filter have the same magnitude.

6. The sensor of claim 1, wherein the separation between internal reflective surfaces and refractive indices of the layers of the first Fabry-Pérot filter are the same as the separation between internal reflective surfaces and refractive indices of the layers of second Fabry-Pérot filter.

7. The sensor of claim 1 wherein the light sensor is characterized by a plurality of regions, and wherein each region is sensitive to a single wavelength or single combination of wavelengths of measurement light.

8. The sensor of claim 1, wherein measurement light emitted from the light source illuminates the first Fabry-Pérot filter at a plurality of angles of incidence.

9. The sensor of claim 8 wherein the light source comprises a light source lens configured such that measurement light incident at each point in the illumination area of the first Fabry-Pérot filter is incident at a predetermined range of angles.

10. The sensor of claim 1 wherein measurement light is incident on the surface of the first Fabry-Pérot filter in a series of parallel lines.

11. The sensor of claim 1, wherein the first optics comprises:

first illumination optics configured to focus filtered measurement light in a first focal plane;

an illumination diffraction grating aligned with the first focal plane such that filtered measurement light is in focus across the illumination diffraction grating; and

second illumination optics configured to focus measurement light diffracted by the illumination diffraction grating in the measurement plane;

and wherein the second optics comprises:

first measurement optics configured to focus measurement light reflected from the measurement plane in a first image plane;

a measurement diffraction grating aligned with the first image plane such that reflected measurement light is in focus across the measurement diffraction grating; and

second measurement optics configured to focus measurement light diffracted by the measurement diffraction grating at infinity.

12. The sensor of claim 11**,** wherein a mean angle of incidence of measurement light on the illumination diffraction grating is less than 5 degrees, and wherein the mean angle of diffraction of light from the measurement diffraction grating is less than 5 degrees.

13. The sensor of claim 1, wherein:

an illumination axis extends from the light source to the measurement plane;

a measurement axis extends from the measurement plane to the light sensor; and

the illumination axis and measurement axis are on the same side of the measurement plane.

14. A sensor for measuring the shape of the surface of a measurement object, the sensor comprising:

the sensor of claim 1;

a stage for holding the measurement object; and

a movement mechanism configured to move the sensor relative to the stage along a first movement vector, or the stage relative to the sensor along the first movement vector;

wherein the measurement plane is offset from the first movement vector by a measurement plane offset angle.

15. Use of the sensor of claim 1 for measuring the displacement of the surface of a measurement object relative to the sensor, measuring the profile of the measurement object, measuring the three-dimensional shape of the measurement object, and/or measuring a thickness of a transparent layer of the measurement object.

16. A method for measuring the surface of a measurement object relative to a sensor, the method comprising:

emitting measurement light from a light source;

filtering the measurement light using a first Fabry-Pérot filter such that all mutually parallel light is of the same wavelength or combination of wavelengths;

focusing the filtered measurement light onto a measurement plane using first optics, wherein the measurement light has a unique wavelength or combination of wavelengths at each point of focus along an axis in the measurement plane;

receiving measurement light reflected from the surface of the measurement object using second optics and directing the reflected measurement light onto a second Fabry-Pérot filter;

filtering the reflected measurement light using the second Fabry-Pérot filter; focusing the filtered reflected measurement light onto a sensor plane using a sensor lens;

and measuring the filtered reflected measurement light at the sensor plane using a light sensor.

17. The method of claim 16, further comprising:

adjusting an angle of the first Fabry-Pérot filter relative to the illumination axis, or adjusting an angle of the second Fabry-Pérot filter relative to the measurement axis, or adjusting both angles, to tune the first and second Fabry-Pérot filters such that measurement light reflected from the measurement plane can pass through the second Fabry-Pérot filter.

18. The method of claim 16, further comprising adjust a distance between reflectors of at least one of said Fabry-Pérot filters such that measurement light reflected from the measurement plane can pass through an other of said Fabry-Pérot filters.

19. The sensor of claim 1, wherein the first Fabry-Pérot filter is configured to be adjustable relative to the illumination axis, the second Fabry-Pérot filter is configured to be adjustable relative to the measurement axis, or both, to tune the first and second Fabry-Pérot filters such that

measurement light reflected from the measurement plane can pass through the second Fabry-Pérot filter.