CLAIMS:

1. A method, comprising:

forming a two-dimensional interrogating beam on a selected sample region of a surface;

collecting light transmitted through or reflected from the sample region with an array of lenses to form a sample array of focus spots;

imaging the sample array of focus spots through an imaging lens on a sensor; and

comparing an image of the sample array of focus spots to a reference array of focus spots to determine a level of non-uniformity in the sample region, optionally.

~~2. The method of claim 1,~~ wherein the light source comprises a laser.

~~3~~2. The method of claim 1, wherein an output beam of a single light source is expanded by at least one beam expanding lens to form the two-dimensional interrogating beam.

~~4~~3. The method of claim 1, wherein the two-dimensional interrogating beam is formed by multiple light sources.

~~5. The method of claim 1, wherein the sensor comprises a CCD or a CMOS camera.~~

~~6. The method of claim 5, wherein the imaging lens comprises: (1) a single element lens, or (2) a multiple element lens combination.~~

~~7. The method of claim 5, wherein the comparing step is performed by a processor internal to the sensor.~~

~~8. The method of claim 5, wherein the comparing step is performed by a processor remote from the sensor.~~

~~9~~4. The method of claim ~~5~~3, wherein the sensor comprises a CCD or a CMOS camera, and further wherein the sample is a moving web of material.

~~10~~5. The method of claim 1, wherein the comparing step compares at least one of the following characteristics of the focus spots in the sample array to that of the focus spots in the reference array: displacement in an X-Y plane, size and intensity.

~~11~~6. The method of claim 1, wherein the comparing step compares a displacement in an X-Y plane of the focus spots in the sample array relative to the locations of the focus spots in the reference array.

~~12~~7. The method of claim 1, wherein the collected light is transmitted through the sample region.

~~13~~8. An apparatus, comprising:

at least one light source that forms a two-dimensional interrogating beam on a selected sample region of a surface;

a lenslet array that captures light transmitted through or reflected from the sample region of the surface to form a sample array of focus spots;

an imaging lens that images the sample array of focus spots produced by the lenslet array on a sensor; and

a processor that determines, relative to a reference array of focus spots, at least one of the following variations in a characteristic of the sample array of focus spots: (1) the displacement in an X-Y plane of a focus spot in the sample array, (2) a size of a focus spot in the sample array, and (3) an intensity of a focus spot in the sample array, wherein the variations are representative of a level of non-uniformity in the sample region, optionally wherein the light source is a laser.

~~14~~9. The apparatus of claim ~~13~~8, wherein the processor determines the displacement of a focus spot in the sample array relative to the reference array of focus spots.

~~15~~10. The apparatus of claim ~~13~~8, further comprising a beam expanding lens between the light source and the surface.

~~16~~11. The apparatus of claim ~~13~~8, wherein multiple light sources form the interrogating beam.

~~17. The apparatus of claim 13, wherein the light source is a laser.~~

~~18~~12. The apparatus of claim ~~13~~ 8, wherein the imaging lens comprises: (1) a single element lens, or (2) a multiple element lens combination.

~~19~~13. The apparatus of claim ~~13~~8, wherein the sensor comprises a CCD or a CMOS camera.

~~20~~14. The apparatus of claim ~~13~~8, wherein the processor is internal to the sensor.

~~21~~15. The apparatus of claim ~~13~~8, wherein the processor is remote from the sensor.

~~22~~16. The apparatus of claim ~~13~~8, wherein the lenslet array captures light transmitted through the sample region.

~~23~~17. A system for monitoring the distortion within a selected sample region on a surface of a material, comprising:

a light source that forms a two-dimensional interrogating beam on the selected sample region of the surface;

a lenslet array that captures light transmitted through or reflected from the sample region of the surface to form a sample array of focus spots;

an imaging lens to image the sample array of focus spots on a sensor; and

a processor that measures, relative to a reference array of focus spots, at least one of the displacement in an X-Y plane, the size and the intensity of the focus spots in the sample array to determine the level of non-uniformity in the sample region.

~~24~~18. The system of claim ~~23~~17, wherein the processor measures, relative to the reference array, the displacement in the X-Y direction of each focus spot in the sample array.

~~25~~19. The system of claim ~~23~~17, wherein the lenslet array captures light transmitted through the surface of the sample region.

~~26~~20. The system of claim ~~23~~17, wherein the surface of the material is non-stationary.

~~27~~21. The system of claim ~~23~~17, wherein the light source is a laser, and wherein the system further comprises a beam expanding lens between the laser and the surface.

~~28~~22. The system of claim ~~23~~17 wherein the imaging lens comprises: (1) a single element lens, or (2) a multiple element lens combination.

~~29~~23. The system of claim ~~23~~17, wherein the processor is remote from the senor.

~~30~~24. A method, comprising:

positioning a light source proximal to a surface of a non-stationary web of a flexible material, wherein the light source forms a two-dimensional interrogating beam on a selected sample region of the surface;

collecting light transmitted through the sample region on a lenslet array, wherein the lenslet array forms a corresponding sample array of focus spots;

imaging the sample array of focus spots through an imaging lens on a sensor of a camera;

processing the image on the sensor to measure, relative to a reference array of focus spots, a displacement in the X-Y direction of each focus spot in the sample array, and computing the non-uniformity in the sample region based on the measured displacements of the focus spots.

~~31. The method of claim 30, wherein the imaging lens comprises: (1) a single element lens, or (2) a multiple element lens combination.~~

~~32. The method of claim 30, wherein the image of the sample array of focus spots is processed by a processor internal to the camera.~~

~~33. The method of claim 30, wherein the image of the sample array of focused spots is processed by a processor remote from the camera.~~

~~34~~25. A method for inspecting web material in real time and computing a distortion level of a selected sample region in a surface of the web material as the web material is manufactured, comprising:

positioning a light source proximal to a surface of a non-stationary web of a flexible material, wherein the light source comprises at least one laser and a beam expanding lens, and wherein the light source forms a two-dimensional interrogating beam on a selected sample region of the surface;

collecting light transmitted through or reflected from the sample region on a lenslet array, wherein the lenslet array forms a corresponding sample array of focus spots;

imaging the sample array of focus spots through an imaging lens on a sensor of a camera;

processing the image on the sensor to measure, relative to a reference array of focus spots, a displacement in the X-Y direction of each focus spot in the sample array, and computing the level of non-uniformity in the sample region based on the measured displacements.

~~35. The method of claim 34, wherein the imaging lens comprises; (1) a single element lens, or (2) a multiple elements lens combination.~~

~~36. The method of claim 34, wherein the image is processed by a processor remote from the CCD camera.~~

~~37. The method of claim 34, further comprising presenting a user interface to output the computed level of non-uniformity to a user.~~

~~38. The method of claim 37, further comprising updating a process control parameter for the manufactured web material in response to the output.~~

~~39. An online computerized inspection system for inspecting web material in real time, the system comprising:~~

~~a light source that forms a two-dimensional interrogating beam on the selected sample region of the surface;~~

~~a lenslet array that captures light transmitted through the sample region of the surface to form a sample array of focus spots;~~

~~an imaging lens to image the sample array of focus spots on a sensor; and~~

a computer executing software to determine the level of non-uniformity in the sample region based on a measured variation in a characteristic of the sample array of focus spots relative to a reference array of focus spots.

40. The system of claim 39, further comprising a memory to store a web inspection model, wherein the computer executes software to compare the non-uniformity in the sample region to the model and compute a severity of a non-uniformity defect in the web material.

41. The system of claim 39, further comprising a user interface to output the severity of the defect to a user.

42. A non-transitory computer readable medium comprising software instructions to cause a computer processor to:

receive, with an online computerized inspection system, an image of a measured sample array of focus spots of one or more sample regions on a surface of a web material during the manufacture thereof;

compare the image of the sample array of focus spots with a reference array of focus spots ; and

compute the severity of a non-uniformity defect in the web material based on the variation in a selected characteristic between the focus spots in the sample array and the focus spots in the reference array.