Claims:

1. A method for measuring testing strain resistance of a specimen on a strain measurement system having an image capturing device, a spatial light modulator, a first light source, a second light source, a beam switching controller, and a processing system comprising:

receiving parameters from a user;

generating a lenslet pattern based on the parameters received;

transmitting said lenslet pattern to said spatial light modulator;

transmitting a frequency and switching sequence to said beam switching controller to alternate said first and second light sources and activate said image capturing device to capture image;

receiving a U image captured by said image capturing device caused by a beam of said first light source and a V image captured by said image capturing device caused by a beam of said second light source;

optimising said image capturing device based on said V and U images received;

displaying said V image and U image to a display in response to said image capturing device being optimised;

transmitting a signal to said beam switching controller to temporary stop activating said first and second light sources and said image capturing device;

receiving an input from said user to being stress measurement;

transmitting a signal to said beam switching controller to continue alternating said first and second light sources and activating said image capturing device to capture image;

receiving a subsequent U image captured by said image capturing device caused by a beam of said first light source and a subsequent V image captured by said image capturing device caused by a beam of said second light source;

displaying said V image and U image to a display;

repeating said step of receiving a subsequent U image and a subsequent V image and said step of displaying said V image and U image.

2. The method according to claim 1 wherein said parameters from said user are strain resolution and strain measurement range.

3. The method according to claim 2, wherein said step of generating said lenslet pattern includes:

determining a lenslet focal length, *f*,

determining a lenslet spacing, *s*;

determining a radial coordinate;

generating said lenslet pattern based on said lenslet spacing and said radial coordinate; and

generating a gray-scale image based on said lenslet pattern generated.

4. The method according to claim 3, wherein said step of determining said lenslet focal length, *f*, includes:

retrieving an angle, β, between an incident direction of said first or second light source and a norm of said specimen surface from a media of said processing system;

retrieving, from said media, a wavelength, λ, of said first or second light source; and

determining a grating pitch, *P*, with the following expression, $P = \frac{\lambda}{\sin\beta}$;

retrieving, from said media, a pixel size of said image capturing device;

determining said lenslet focal length, *f*, using said strain resolution, ε_{res}, with the following expression, $f = \frac{P}{2\lambda\varepsilon_{res}} \times pixel\ size$;

5. The method according to claim 4, wherein said step of determining said lenslet spacing, s, includes:

retrieving, from said media, an operating range of said spatial light modulator;

comparing said strain measurement range with said operating range;

determining said lenslet spacing, s, in response to said strain measurement range being lesser than or equal to said operating range, with the following expression, $s = \frac{f\lambda}{p}$; and

determining said lenslet spacing, s, in response to said strain measurement range being greater than said operating range, with the following expressions, $s > required\ range \times \frac{2f\lambda}{p}$ and $s = \frac{(2n+1)f\lambda}{n(n+1)p}$, where n = 1, 2, 3...

6. The method according to claim 5, wherein said step of determining said radial coordinate includes:

determining said radial coordinate with the following expression, $\phi(r) \approx 2\pi(a_2 r^2)$ where $a_2 = \frac{1}{2f\lambda}$.

7. The method according to claim 6, wherein said step of optimising said image capturing device based on said V and U images received includes:

binarising said V and U images;

collating and sorting bright spots in said V and U images above a pre-defined pixel size into an array of dots to form a matrix;

determining horizontal and vertical pitches of said matrix;

comparing said horizontal and vertical pitches with said lenslet spacing;

increasing an exposure time of said image capturing device in response to one of said horizontal and vertical pitches being smaller than said lenslet spacing by a pre-defined threshold value;

decreasing said exposure time of said image capturing device in response to one of said horizontal and vertical pitches being greater than said lenslet spacing by said pre-defined threshold value; and

storing a location of each of said bright spots as reference positions for each of said U and V field images in said media in response to each of said horizontal and vertical pitches being within said lenslet spacing by said pre-defined threshold value.

8. The method according to claim 6, wherein said step of displaying said V image and U image to said display include:

determining said location of each of said bright spots;

computing a first normal strain value for each of said bright spots in said U image with the following expression,

$$\varepsilon_x = \frac{du}{dx} = \frac{\Delta x}{2f \sin\beta} = \frac{P}{2f\lambda}\Delta x,$$

where Δx is the x displacement of said reference positions for each of said bright spots in said U image;

computing a second normal strain value for each of said bright spots in said V image with the following expression,

$$\varepsilon_y = \frac{dv}{dy} = \frac{\Delta y}{2f \sin\beta} = \frac{P}{2f\lambda}\Delta y,$$

where Δy is the y displacement of said reference positions for each of said bright spots in said V image;

computing a shear strain value for each of said bright spots with the following expression,

$$\varepsilon_{xy} = \frac{1}{2}(\Delta\theta_1 + \Delta\theta_2)$$

where $\Delta\theta_1 = \frac{du}{dy} = \frac{\Delta y}{2f \sin\beta}$, $\Delta\theta_2 = \frac{dv}{dx} = \frac{\Delta x}{2f \sin\beta}$, Δx and Δy are the x and y displacements of said reference positions for each of said bright spots in each of said U and V images;

displaying said U and V field images with said first normal strain value, said second normal strain value and said shear strain value for each of said bright spots.

9. A processing system for measuring testing strain resistance of a specimen on a strain measurement system having an image capturing device, a spatial light modulator, a first light source, a second light source and a beam switching controller, the processing system comprising:

an operation and control module;

an image optimisation module;

a dynamic lenslet pattern generation module;

an image analytics module;

said operation and control module being configured to perform the following steps in response an initialisation process:

receiving parameters from a user;

transmitting said parameters to said dynamic lenslet pattern generation module;

receiving a lenslet pattern generated by said dynamic pattern generation module;

transmitting said lenslet pattern to said spatial light modulator;

transmitting a frequency and switching sequence to said beam switching controller to alternate said first and second light sources and activate said image capturing device to capture image;

receiving a U image captured by said image capturing device caused by a beam of said first light source and a V image captured by said image capturing device caused by a beam of said second light source;

transmitting said U image and V image to said image optimisation module for optimising said image capturing device based on said V and U images received in response to said image capturing device being optimised;

transmitting said U image and V image to said image analytics module for displaying said U image and V image to a display;

transmitting a signal to said beam switching controller to temporary stop activating said first and second light sources and said image capturing device;

receiving an input from said user to being stress measurement;

transmitting a signal to said beam switching controller to continue alternating said first and second light sources and activating said image capturing device to capture image;

receiving a subsequent U image captured by said image capturing device caused by a beam of said first light source and a subsequent V image captured by said image capturing device caused by a beam of said second light source;

transmitting said subsequent U image and V image to said image analytics module for displaying said V image and U image to said display; and

repeating said step of receiving a subsequent U image and a subsequent V image and said step of transmitting said V image and U image to said image analytics module.

10. The processing system according to claim 9 wherein said parameters from said user are strain resolution and strain measurement range.

11. The processing system according to claim 10, wherein said dynamic lenslet pattern generation module performs the following steps in response to receiving said parameters from said operation and control module:

determining a lenslet focal length, *f*,

determining a lenslet spacing, *s*;

determining a radial coordinate;

generating said lenslet pattern based on said lenslet spacing and said radial coordinate; and

generating a gray-scale image based on said lenslet pattern generated; and

transmitting said gray-scale image to said operation and control module.

12. The processing system according to claim 11, wherein said step of determining said lenslet focal length, *f*, includes:

retrieving, from a media of said processing system, an angle, β, between an incident direction of said first or second light source and a norm of said specimen surface;

retrieving, from said media, a wavelength, λ, of said first or second light source; and

determining a grating pitch, *P*, with the following expression, $P = \frac{\lambda}{\sin\beta}$;

retrieving, from said media, a pixel size of said image capturing device;

determining said lenslet focal length, *f*, using said strain resolution, ε_{res}, with the following expression, $f = \frac{P}{2\lambda\varepsilon_{res}} \times pixel\ size$;

13. The processing system according to claim 12, wherein said step of determining said lenslet spacing, s, includes:

retrieving, from said media, an operating range of said spatial light modulator;

comparing said strain measurement range with said operating range;

determining said lenslet spacing, s, in response to said strain measurement range being lesser than or equal to said operating range, with the following expression, $s = \frac{f\lambda}{p}$; and

determining said lenslet spacing, s, in response to said strain measurement range being greater than said operating range, with the following expressions, $s > required\,range \times \frac{2f\lambda}{P}$ and $s \neq \frac{(2n+1)f\lambda}{n(n+1)p}$, where n = 1, 2, 3...

14. The processing system according to claim 13, wherein said step of determining said radial coordinate includes instructions to:

determining said radial coordinate with the following expression, $\phi(r) \approx 2\pi(a_2 r^2)$ where $a_2 = \frac{1}{2f\lambda}$.

15. The processing system according to claim 14, wherein said image optimisation module performs the following steps in response to receiving said U image and V image:

binarising said V and U images;

collating and sorting bright spots in said V and U images above a pre-defined pixel size into an array of dots to form a matrix;

determining horizontal and vertical pitches of said matrix;

comparing said horizontal and vertical pitches with said lenslet spacing;

increasing an exposure time of said image capturing device in response to one of said horizontal and vertical pitches being smaller than said lenslet spacing by a pre-defined threshold value;

decreasing said exposure time of said image capturing device in response to one of said horizontal and vertical pitches being greater than said lenslet spacing by said pre-defined threshold value; and

storing a location of each of said bright spots as reference positions for each of said U and V field images in said media in response to each of said horizontal and vertical pitches being within said lenslet spacing by said pre-defined threshold value.

16. The processing system according to claim 15, wherein said image analytics module performs the following steps in response to receiving said U image and V image:

determining said location of each of said bright spots;

computing a first normal strain value for each of said bright spots in said U image with the following expression,

$$\varepsilon_x = \frac{du}{dx} = \frac{\Delta x}{2f \sin\beta} = \frac{P}{2f\lambda}\Delta x,$$

where Δx is the x displacement of said reference positions for each of said bright spots in said U image;

computing a second normal strain value for each of said bright spots in said V image with the following expression,

$$\varepsilon_y = \frac{dv}{dy} = \frac{\Delta y}{2f \sin\beta} = \frac{P}{2f\lambda}\Delta y,$$

where Δy is the y displacement of said reference positions for each of said bright spots in said V image;

computing a shear strain value for each of said bright spots with the following expression,

$$\varepsilon_{xy} = \frac{1}{2}(\Delta\theta_1 + \Delta\theta_2)$$

where $\Delta\theta_1 = \frac{du}{dy} = \frac{\Delta y}{2f \sin\beta}$, $\Delta\theta_2 = \frac{dv}{dx} = \frac{\Delta x}{2f \sin\beta}$, Δx and Δy are the x and y displacements of said reference positions for each of said bright spots in each of said U and V images;

displaying said U and V field images with said first normal strain value, said second normal strain value and said shear strain value for each of said bright spots.

17. A processing system for measuring testing strain resistance of a specimen on a strain measurement system having an image capturing device, a spatial light modulator, a first light source, a second light source and a beam switching controller, the processing system comprising:

a processing unit:

instructions for directing said processing unit to:

receiving parameters from a user;

generating a lenslet pattern based on the parameters received;

transmitting said lenslet pattern to said spatial light modulator;

transmitting a frequency and switching sequence to said beam switching controller to alternate said first and second light sources and activate said image capturing device to capture image;

receiving a U image captured by said image capturing device caused by a beam of said first light source and a V image captured by said image capturing device caused by a beam of said second light source;

optimising said image capturing device based on said V and U images received;

displaying said V image and U image to a display in response to said image capturing device being optimised;

transmitting a signal to said beam switching controller to temporary stop activating said first and second light sources and said image capturing device;

receiving an input from said user to being stress measurement;

transmitting a signal to said beam switching controller to continue alternating said first and second light sources and activating said image capturing device to capture image;

receiving a subsequent U image captured by said image capturing device caused by a beam of said first light source and a subsequent V image captured by said image capturing device caused by a beam of said second light source;

displaying said V image and U image to a display;

repeating said step of receiving a subsequent U image and a subsequent V image and said step of displaying said V image and U image; and

a media readable by said processing unit that stores said instructions.

18. The processing system according to claim 17 wherein said parameters from said user are strain resolution and strain measurement range.

19. The processing system according to claim 18, wherein said instructions to generating said lenslet pattern includes instructions to:

determining a lenslet focal length, *f*,

determining a lenslet spacing, *s*;

determining a radial coordinate;

generating said lenslet pattern based on said lenslet spacing and said radial coordinate; and

generating a gray-scale image based on said lenslet pattern generated.

20. The processing system according to claim 19, wherein said instructions to determining said lenslet focal length, *f*, includes instructions to:

retrieving, from said media, an angle, β, between an incident direction of said first or second light source and a norm of said specimen surface;

retrieving, from said media, a wavelength, λ, of said first or second light source; and

determining a grating pitch, *P*, with the following expression, $P = \frac{\lambda}{\sin\beta}$;

retrieving, from said media, a pixel size of said image capturing device;

determining said lenslet focal length, *f*, using said strain resolution, ε_{res}, with the following expression, $f = \frac{P}{2\lambda\varepsilon_{res}} \times pixel\ size$;

21. The processing system according to claim 20, wherein said instructions to determining said lenslet spacing, *s*, includes instructions to:

retrieving, from said media, an operating range of said spatial light modulator;

comparing said strain measurement range with said operating range;

determining said lenslet spacing, *s*, in response to said strain measurement range being lesser than or equal to said operating range, with the following expression, $s = \frac{f\lambda}{p}$; and

determining said lenslet spacing, *s*, in response to said strain measurement range being greater than said operating range, with the following expressions, $s > required\ range \times \frac{2f\lambda}{P}$ and $s = \frac{(2n+1)f\lambda}{n(n+1)p}$, where n = 1, 2, 3...

22. The processing system according to claim 21, wherein said instructions to determining said radial coordinate includes instructions to:

determining said radial coordinate with the following expression, $\phi(r) \approx 2\pi(a_2 r^2)$ where $a_2 = \frac{1}{2f\lambda}$.

23. The processing system according to claim 22, wherein said instructions to optimising said image capturing device based on said V and U images received includes instructions to:

binarising said V and U images;

collating and sorting bright spots in said V and U images above a pre-defined pixel size into an array of dots to form a matrix;

determining horizontal and vertical pitches of said matrix;

comparing said horizontal and vertical pitches with said lenslet spacing;

increasing an exposure time of said image capturing device in response to one of said horizontal and vertical pitches being smaller than said lenslet spacing by a pre-defined threshold value;

decreasing said exposure time of said image capturing device in response to one of said horizontal and vertical pitches being greater than said lenslet spacing by said pre-defined threshold value; and

storing a location of each of said bright spots as reference positions for each of said U and V field images in said media in response to each of said horizontal and vertical pitches being within said lenslet spacing by said pre-defined threshold value.

24. The processing system according to claim 23, wherein said instructions to displaying said V image and U image to said display include instructions to:

determining said location of each of said bright spots;

computing a first normal strain value for each of said bright spots in said U image with the following expression,

$$\varepsilon_x = \frac{du}{dx} = \frac{\Delta x}{2f \sin\beta} = \frac{P}{2f\lambda}\Delta x,$$

where Δx is the x displacement of said reference positions for each of said bright spots in said U image;

computing a second normal strain value for each of said bright spots in said V image with the following expression,

$$\varepsilon_y = \frac{dv}{dy} = \frac{\Delta y}{2f \sin\beta} = \frac{P}{2f\lambda}\Delta y,$$

where Δy is the y displacement of said reference positions for each of said bright spots in said V image;

computing a shear strain value for each of said bright spots with the following expression,

$$\varepsilon_{xy} = \frac{1}{2}(\Delta\theta_1 + \Delta\theta_2)$$

where $\Delta\theta_1 = \frac{du}{dy} = \frac{\Delta y}{2f \sin\beta}$, $\Delta\theta_2 = \frac{dv}{dx} = \frac{\Delta x}{2f \sin\beta}$, Δx and Δy are the x and y displacements of said reference positions for each of said bright spots in each of said U and V images;

displaying said U and V field images with said first normal strain value, said second normal strain value and said shear strain value for each of said bright spots.

Claims:

1. A method for measuring strain of a specimen on a strain measurement system having an image capturing device, a spatial light modulator, a first light source, a second light source, a beam switching controller, and a processing system, the method comprising:

receiving parameters from a user;

generating a lenslet pattern based on the parameters received;

transmitting said lenslet pattern to said spatial light modulator;

transmitting a frequency and switching sequence to said beam switching controller to alternate said first and second light sources and activate said image capturing device to capture images;

receiving a first image captured by said image capturing device caused by a beam of said first light source and a second image captured by said image capturing device caused by a beam of said second light source;

optimising said image capturing device based on said second and first images received;

displaying said second image and first image on a display in response to said image capturing device being optimised;

transmitting a signal to said beam switching controller to temporarily stop alternating said first and second light sources and activating said image capturing device;

receiving an input from said user to begin stress measurement;

transmitting a signal to said beam switching controller to continue alternating said first and second light sources and activating said image capturing device to capture images;

receiving a subsequent first image captured by said image capturing device caused by a beam of said first light source and a subsequent second image captured by said image capturing device caused by a beam of said second light source; and

displaying said second image and first image on the display.

2. The method according to claim 1, wherein said parameters from said user comprise a strain resolution and a strain measurement range.

3. The method according to claim 2, wherein said step of generating said lenslet pattern comprises:

determining a lenslet spacing, s;

determining a radial coordinate;

generating said lenslet pattern based on said lenslet spacing and said radial coordinate; and

generating a gray-scale image based on said lenslet pattern generated.

4. The method according to claim 3, further comprising:

retrieving an angle, β, between an incident direction of said first or second light source and a norm of a surface of the specimen from a media of said processing system;

retrieving, from said media, a wavelength, λ, of said first or second light source;

determining a grating pitch, P, with the following expression, $P = \frac{\lambda}{\sin\beta}$;

retrieving, from said media, a pixel size of said image capturing device; and

determining a lenslet focal length, f, using said strain resolution, ε_{res}, with the following expression, $f = \frac{P}{2\lambda\varepsilon_{res}} \times pixel\ size.$

5. The method according to claim 4, wherein said step of determining said lenslet spacing, s, comprises:

retrieving, from said media, an operating range of said spatial light modulator;

comparing said strain measurement range with said operating range;

determining said lenslet spacing, s, if said strain measurement range is less than or equal to said operating range, with the following expression, $s = \frac{f\lambda}{p}$; and

determining said lenslet spacing, s, if said strain measurement range is greater than said operating range, with the following expressions, $s > required\ range \times \frac{2f\lambda}{P}$ and $s = \frac{(2n+1)f\lambda}{n(n+1)p}$, where n = 1, 2, 3....

6. The method according to claim 5, wherein said step of determining said radial coordinate comprises:

determining said radial coordinate, $\phi(r)$, with the following expression, $\phi(r) \approx 2\pi(a_2 r^2)$ where $a_2 = \frac{1}{2f\lambda}$.

7. The method according to claim 6, wherein said step of optimising said image capturing device based on said second and first images received comprises:

making binary said second and first images;

collating and sorting bright spots in said second and first images that are above a pre-defined pixel size into an array of dots to form a matrix;

determining horizontal and vertical pitches of said matrix;

comparing said horizontal and vertical pitches with said lenslet spacing;

increasing an exposure time of said image capturing device if one of said horizontal and vertical pitches is smaller than said lenslet spacing by a pre-defined threshold value;

decreasing said exposure time of said image capturing device if one of said horizontal and vertical pitches is greater than said lenslet spacing by said pre-defined threshold value; and

storing a location of each of said bright spots as reference positions for each of said first and second images in said media if each of said horizontal and vertical pitches is within said lenslet spacing by said pre-defined threshold value.

8. The method according to claim 7, wherein said step of displaying said second image and first image on said display comprises:

determining locations of each of said bright spots;

computing a first normal strain value, ε_x, for each of said bright spots in said first image with the following expression,

$$\varepsilon_x = \frac{du}{dx} = \frac{\Delta x}{2f \sin\beta} = \frac{P}{2f\lambda}\Delta x,$$

where Δx is an x displacement of said reference positions for each of said bright spots in said first image;

computing a second normal strain value, ε_y, for each of said bright spots in said second image with the following expression,

$\varepsilon_y = \frac{dv}{dy} = \frac{\Delta y}{2f \sin\beta} = \frac{P}{2f\lambda}\Delta y,$

where Δy is a y displacement of said reference positions for each of said bright spots in said second image;

computing a shear strain value, ε_{xy}, for each of said bright spots with the following expression,

$$\varepsilon_{xy} = \frac{1}{2}(\Delta\theta_1 + \Delta\theta_2)$$

where $\Delta\theta_1 = \frac{du}{dy} = \frac{\Delta y}{2f \sin\beta}$, $\Delta\theta_2 = \frac{dv}{dx} = \frac{\Delta x}{2f \sin\beta}$, Δx and Δy are the x and y displacements of said reference positions for each of said bright spots in each of said first and second images; and

displaying said first and second images with said first normal strain value, said second normal strain value and said shear strain value for each of said bright spots.

9. A processing system for measuring strain of a specimen on a strain measurement system having an image capturing device, a spatial light modulator, a first light source, a second light source and a beam switching controller, the processing system comprising:

an operation and control module;

an image optimisation module;

a dynamic lenslet pattern generation module; and

an image analytics module,

wherein said operation and control module is configured to perform the following steps in response to an initialisation process:

receiving parameters from a user;

transmitting said parameters to said dynamic lenslet pattern generation module;

receiving a lenslet pattern generated by said dynamic pattern generation module;

transmitting said lenslet pattern to said spatial light modulator;

transmitting a frequency and switching sequence to said beam switching controller to alternate said first and second light sources and activate said image capturing device to capture images;

receiving a first image captured by said image capturing device caused by a beam of said first light source and a second image captured by said image capturing device caused by a beam of said second light source;

transmitting said first image and second image to said image optimisation module for optimising said image capturing device based on said second and first images received in response to said image capturing device being optimised;

transmitting said first image and second image to said image analytics module for displaying said first image and second image on a display;

transmitting a signal to said beam switching controller to temporarily stop alternating said first and second light sources and activating said image capturing device;

receiving an input from said user to begin stress measurement;

transmitting a signal to said beam switching controller to continue alternating said first and second light sources and activating said image capturing device to capture images;

receiving a subsequent first image captured by said image capturing device caused by a beam of said first light source and a subsequent second image captured by said image capturing device caused by a beam of said second light source; and

transmitting said subsequent first image and second image to said image analytics module for displaying said second image and first image on said display.

10. The processing system according to claim 9, wherein said parameters from said user comprise a strain resolution and a strain measurement range.

11. The processing system according to claim 10, wherein said dynamic lenslet pattern generation module performs the following steps in response to receiving said parameters from said operation and control module:

determining a lenslet spacing, s;

determining a radial coordinate;

generating said lenslet pattern based on said lenslet spacing and said radial coordinate;

generating a gray-scale image based on said lenslet pattern generated; and

transmitting said gray-scale image to said operation and control module.

12. The processing system according to claim 11, wherein said dynamic lenslet pattern generation module performs the following steps in response to receiving said parameters from said operation and control module:

retrieving, from a media of said processing system, an angle, β, between an incident direction of said first or second light source and a norm of a surface of the specimen;

retrieving, from said media, a wavelength, λ, of said first or second light source;

determining a grating pitch, P, with the following expression, $P = \frac{\lambda}{\sin\beta}$;

retrieving, from said media, a pixel size of said image capturing device; and

determining a lenslet focal length, f, using said strain resolution, ε_{res}, with the following expression, $f = \frac{P}{2\lambda\varepsilon_{res}} \times pixel\ size$.

13. The processing system according to claim 12, wherein said step of determining said lenslet spacing, s, comprises:

retrieving, from said media, an operating range of said spatial light modulator;

comparing said strain measurement range with said operating range;

determining said lenslet spacing, s, if said strain measurement range is less than or equal to said operating range, with the following expression, $s = \frac{f\lambda}{p}$; and

determining said lenslet spacing, s, if said strain measurement range is greater than said operating range, with the following expressions, $s > required\ range \times \frac{2f\lambda}{P}$ and $s = \frac{(2n+1)f\lambda}{n(n+1)p}$, where n = 1, 2, 3....

14. The processing system according to claim 13, wherein said step of determining said radial coordinate comprises:

determining said radial coordinate, $\phi(r)$, with the following expression, $\phi(r) \approx 2\pi(a_2 r^2)$ where $a_2 = \frac{1}{2f\lambda}$.

15. The processing system according to claim 14, wherein said image optimisation module performs the following steps in response to receiving said first image and second image:

making binary said second and first images;

collating and sorting bright spots in said second and first images that are above a pre-defined pixel size into an array of dots to form a matrix;

determining horizontal and vertical pitches of said matrix;

comparing said horizontal and vertical pitches with said lenslet spacing;

increasing an exposure time of said image capturing device if one of said horizontal and vertical pitches is smaller than said lenslet spacing by a pre-defined threshold value;

decreasing said exposure time of said image capturing device if one of said horizontal and vertical pitches is greater than said lenslet spacing by said pre-defined threshold value; and

storing a location of each of said bright spots as reference positions for each of said first and second images in said media if each of said horizontal and vertical pitches is within said lenslet spacing by said pre-defined threshold value.

16. The processing system according to claim 15, wherein said image analytics module performs the following steps in response to receiving said first image and second image:

determining locations of each of said bright spots;

computing a first normal strain value, ε_x, for each of said bright spots in said first image with the following expression,

$$\varepsilon_x = \frac{du}{dx} = \frac{\Delta x}{2f \sin\beta} = \frac{P}{2f\lambda}\Delta x,$$

where Δx is an x displacement of said reference positions for each of said bright spots in said first image;

computing a second normal strain value, ε_y, for each of said bright spots in said second image with the following expression,

$$\varepsilon_y = \frac{dv}{dy} = \frac{\Delta y}{2f \sin\beta} = \frac{P}{2f\lambda}\Delta y,$$

where Δy is a y displacement of said reference positions for each of said bright spots in said second image;

computing a shear strain value, ε_{xy}, for each of said bright spots with the following expression,

$$\varepsilon_{xy} = \frac{1}{2}(\Delta\theta_1 + \Delta\theta_2)$$

where $\Delta\theta_1 = \frac{du}{dy} = \frac{\Delta y}{2f \sin\beta}$, $\Delta\theta_2 = \frac{dv}{dx} = \frac{\Delta x}{2f \sin\beta}$, Δx and Δy are the x and y displacements of said reference positions for each of said bright spots in each of said first and second images; and

displaying said first and second images with said first normal strain value, said second normal strain value and said shear strain value for each of said bright spots.

17. A processing system for measuring strain of a specimen on a strain measurement system having an image capturing device, a spatial light modulator, a first light source, a second light source and a beam switching controller, the processing system comprising:

a processor;

memory storing instructions that, when executed by said processor, cause the processing system to perform the following steps:

receiving parameters from a user;

generating a lenslet pattern based on the parameters received;

transmitting said lenslet pattern to said spatial light modulator;

transmitting a frequency and switching sequence to said beam switching controller to alternate said first and second light sources and activate said image capturing device to capture images;

receiving a first image captured by said image capturing device caused by a beam of said first light source and a second image captured by said image capturing device caused by a beam of said second light source;

optimising said image capturing device based on said second and first images received;

displaying said second image and first image on a display in response to said image capturing device being optimised;

transmitting a signal to said beam switching controller to temporarily stop alternating said first and second light sources and activating said image capturing device;

receiving an input from said user to begin stress measurement;

transmitting a signal to said beam switching controller to continue alternating said first and second light sources and activating said image capturing device to capture images;

receiving a subsequent first image captured by said image capturing device caused by a beam of said first light source and a subsequent second image captured by said image capturing device caused by a beam of said second light source; and

displaying said second image and first image on a display.

18. The processing system according to claim 17, wherein said parameters from said user comprise a strain resolution and a strain measurement range.

19. The processing system according to claim 18, wherein generating said lenslet pattern comprises:

determining a lenslet spacing, s;

determining a radial coordinate;

generating said lenslet pattern based on said lenslet spacing and said radial coordinate; and

generating a gray-scale image based on said lenslet pattern generated.

20. The processing system according to claim 19, wherein the memory stores instructions that, when executed by said processor, cause the processing system to perform the following steps:

retrieving, from said memory, an angle, β, between an incident direction of said first or second light source and a norm of a surface of the specimen;

retrieving, from said memory, a wavelength, λ, of said first or second light source;

determining a grating pitch, P, with the following expression, $P = \frac{\lambda}{\sin\beta}$;

retrieving, from said memory, a pixel size of said image capturing device; and

determining a lenslet focal length, f, using said strain resolution, ε_{res}, with the following expression, $f = \frac{P}{2\lambda\varepsilon_{res}} \times pixel\ size.$

21. The processing system according to claim 20, wherein determining said lenslet spacing, *s*, comprises:

retrieving, from said memory, an operating range of said spatial light modulator;

comparing said strain measurement range with said operating range;

determining said lenslet spacing, *s*, if said strain measurement range is less than or equal to said operating range, with the following expression, $s = \frac{f\lambda}{p}$; and

determining said lenslet spacing, *s*, if said strain measurement range is greater than said operating range, with the following expressions, $s > required\ range \times \frac{2f\lambda}{P}$ and $s = \frac{(2n+1)f\lambda}{n(n+1)p}$, where n = 1, 2, 3....

22. The processing system according to claim 21, wherein determining said radial coordinate, $\phi(r)$, comprises:

determining said radial coordinate with the following expression, $\phi(r) \approx 2\pi(a_2 r^2)$ where $a_2 = \frac{1}{2f\lambda}$.

23. The processing system according to claim 22, wherein optimising said image capturing device based on said second and first images received comprises:

making binary said second and first images;

collating and sorting bright spots in said second and first images that are above a pre-defined pixel size into an array of dots to form a matrix;

determining horizontal and vertical pitches of said matrix;

comparing said horizontal and vertical pitches with said lenslet spacing;

increasing an exposure time of said image capturing device if one of said horizontal and vertical pitches is smaller than said lenslet spacing by a pre-defined threshold value;

decreasing said exposure time of said image capturing device if one of said horizontal and vertical pitches is greater than said lenslet spacing by said pre-defined threshold value; and

storing a location of each of said bright spots as reference positions for each of said first and second images in said memory if each of said horizontal and vertical pitches is within said lenslet spacing by said pre-defined threshold value.

24. The processing system according to claim 23, wherein displaying said second image and first image on said display comprises:

determining locations of each of said bright spots;

computing a first normal strain value, ε_x, for each of said bright spots in said first image with the following expression,

$$\varepsilon_x = \frac{du}{dx} = \frac{\Delta x}{2f \sin\beta} = \frac{P}{2f\lambda}\Delta x,$$

where Δx is an x displacement of said reference positions for each of said bright spots in said first image;

computing a second normal strain value, ε_y, for each of said bright spots in said second image with the following expression,

$$\varepsilon_y = \frac{dv}{dy} = \frac{\Delta y}{2f \sin\beta} = \frac{P}{2f\lambda}\Delta y,$$

where Δy is a y displacement of said reference positions for each of said bright spots in said second image;

computing a shear strain value, ε_{xy}, for each of said bright spots with the following expression,

$$\varepsilon_{xy} = \frac{1}{2}(\Delta\theta_1 + \Delta\theta_2)$$

where $\Delta\theta_1 = \frac{du}{dy} = \frac{\Delta y}{2f \sin\beta}$, $\Delta\theta_2 = \frac{dv}{dx} = \frac{\Delta x}{2f \sin\beta}$, Δx and Δy are the x and y displacements of said reference positions for each of said bright spots in each of said first and second images; and

displaying said first and second images with said first normal strain value, said second normal strain value and said shear strain value for each of said bright spots.