CLAIMS

1. A method for imaging of a sample, the method including the steps of:
    1. recording images from at least one projection angle and carrying out image pair cross-correlation analysis encoding velocity data for the sample in terms of Cartesian coordinates; and
    2. reconstructing a 2D or 3D velocity field directly from the image pair cross-correlations from the analysis;

wherein the reconstruction is performed without first reconstructing 2D or 3D images and wherein steps 1 and 2 are automated.

2. A method for imaging of a sample according to claim 1, wherein step 2 includes:
    2(a) using an iterative method or alternatively a direct method, reconstructing a 3D velocity field directly from the image pair cross-correlations from the analysis; and
    2(b) repeating the iterative method or direct method to produce a 4D velocity field;

wherein the method includes the further step of using the 4D velocity field to provide further information.

3. A method for imaging of a sample, according to claim 1 wherein step 1 includes:
    1(a) recording images from multiple projection angles;
    1(b) allocating images into rectangular interrogation windows;
    1(c) deriving velocity components u, v and w in the x, y and z directions from the images; and
    1(d) carrying out cross-correlation analysis on image pairs defined by the interrogation windows.

4. A method for imaging of a sample according to any one of claims 1 to 3 wherein step 1 includes:

1(a) recording images from at least one projection angle and carrying out image pair cross-correlation analysis to measure encoded parameters of;

(i) velocity (u, v and w) against time opposite Cartesian co-ordinates (x, y and z),

(ii) a further physical parameter (p) chosen from the group comprising pressure or volume;

and step 2 includes:

2(a) integrating the measurements to provide a single 3D velocity field; and

2(b) describing regional compliance in terms of derivatives defined by $(\delta u/\delta x + \delta v/\delta y + \delta w/\delta z) / \delta p$.

5. A method for imaging of a sample according to any one of claims 1 to 3 wherein step 1 includes:

1(a) recording images from at least one projection angle and carrying out image pair cross-correlation analysis to measure encoded parameters of;

(i) motion (u and v) opposite Cartesian co-ordinates (x and y), and

(ii) sample thickness (t), pressure (p) and volume (V);

and step 2 includes:

2(a) integrating the measurements to provide a single 3D velocity field;

2(b) describing regional compliance in terms of derivatives defined by $(\delta u/\delta x + \delta v/\delta y + \delta w/\delta z) / \delta p$; and

2(c) solving for t, by mathematical comparison of total compliance with the total compliance determined by adding the regional compliances, according to,

$$t = V / \Sigma /(\delta u/\delta x + \delta v/\delta y).$$

6. A method according to any one of the preceding claims which further includes the steps of:

3(a) segmenting an image of the sample; and

3(b) associating each segment with regions of the 2D or 3D ~~data~~velocity field.

7. A method according to any one of the preceding claims wherein the projection angle covers a range of between 1° and 360°, more preferably between 30° and 180°.

8. A method according to any one of the preceding claims wherein the sample comprises human or animal tissue and the method is used for measuring motion.

9. A method according to claim 8 wherein the motion of tissue is measured.

10. A method according to claim 8 wherein the motion of a fluid is measured, the motion being chosen from the group comprising air, blood, lymph or combinations thereof.

11. An application adapted to enable imaging, said application comprising a predetermined instruction set adapted to enable a method according to any one of claims 1 to 10.

12. A computer program product comprising a computer usable medium having computer readable program code and computer readable system code embodied on said medium, and an application to enable image pair cross-correlation analysis and reconstruction of velocity fields according to any one of claims 1 to 10.

13. An apparatus when used for the method of any one of claims 1 to 10, the apparatus comprising:

(i) one or more energy source;

(ii) one or more detector for recording images created by energy from the one or more energy sources passing through a sample; and

(iii) a sample retainer for locating the sample intermediate the one or more energy sources and the one or more detectors;

wherein in use, the sample retainer rotates the sample through multiple energy projection angles and at least one image is recorded at each of the projection angles.

14. An apparatus when used for the method of any one of claims 1 to 10, the apparatus comprising:

(i) one or more energy source; and

(ii) one or more detectors for recording images created by energy from the one or more energy sources passing through a sample;

wherein in use, a sample is located intermediate the one or more energy sources and the one or more detectors, the sources and detectors being rotated relative to the sample through multiple energy projection angles and at least one image of the sample is recorded at each of the projection angles.

15. An apparatus when used for the method of any one of claims 1 to 10 the apparatus comprising:

(i) two or more energy sources having respective projection angles; and

(ii) one or more detectors for recording images created by energy from the energy sources as it passes through a sample;

wherein recordings at each of the projection angles are made simultaneously.

16. A computer implemented system ~~when~~ used for control of the apparatus used according to any one of claims 13 to 15.

~~17. A method for providing an image of a sample comprising the steps of:~~

~~1. recording images encoding data for the sample in terms of Cartesian coordinates;~~

~~2. reconstructing a 2D or 3D data field from the information encoded in the recorded images;~~

~~3(a) segmenting an image of the sample; and~~

~~3(b) associating each segment with regions of the 2D or 3D data field wherein steps 1 to 3 are automated.~~

~~18. A method according to claim 17 wherein the sample comprises human or animal tissue and the method is used for measuring motion.~~

~~19. A method according to claim 18 wherein the motion of tissue is measured.~~

~~20. A method according to claim 18 wherein the motion of a fluid is measured, the motion being chosen from the group comprising air, blood, lymph or combinations thereof.~~

~~21. An application adapted to enable imaging said application comprising a predetermined instruction set adapted to enable a method according to claim 17.~~

~~22. A computer program product comprising a computer usable medium having computer readable program code and computer readable system code embodied on said medium, and an application to enable imaging according to claim 21.~~