between the various zones, whereas the Tikhonov regularization method offers little contrast; this is a drawback in the applications aimed at the detection of tumors.

An echography apparatus provided with means for carrying out the method illustrated in the FIGS. **1** and **2** thus constitutes an excellent non-invasive means for the detection of tumors, notably for the detection of breast tumors.

What is claimed is:

1. A method of detecting elasticity variations in a soft tissue which is subjected to an external compression in a predetermined axial direction comprising:

estimating a field of axial displacements in the tissue,

determining an elasticity modulus estimator, including an operation for minimizing a distance between an image of a distribution of elementary elasticity moduli, by a Finite Element Model, and the field of axial displacements, and

regularizating the solution of the estimator by means of a diagonal matrix (R) whose coefficients $[\alpha_{ii}](\alpha_{ii})$ are functions of the axial displacements (d_i) which are applied to the respective values of the elementary elasticity moduli (e_i) in order to ensure that these elementary elasticity modulus values remain within a uniform interval which is centered around a mean value which is specific to each elementary elasticity modulus.

2. A method as claimed in claim **1**, wherein the elasticity modulus estimator is determined by forming a matrix (M) formulated as:

$$M=[S^TS+R]^{-1}S^T,$$

where R is the diagonal regularization matrix and where S is a sensitivity matrix which is a function of the axial displacements, and by performing the matrix multiplication of said matrix (M) by the displacement field vector (d).

3. A method as claimed in claim **2**, further comprising:

coupling an ultrasonic probe associated with an echography apparatus to the soft tissue, said probe emitting the receiving echographic signals parallel to the axial compression direction of the tissue, and

estimating the axial displacement field vector in the tissue by utilizing a 1-bit temporal correlation technique for the echographic signals.

4. An echography apparatus for detecting elasticity variations in a soft tissue comprising:

an ultrasonic probe,

means for focusing and scanning the probe which is coupled to a reference surface of the tissue and emits and receives echographic signals parallel to an axial direction of the tissue,

means for 1-bit correlation of the echographic signals,

means for estimating a field of axial displacements in the tissue,

a system for estimating the elasticity modulus in order to perform an operation for minimizing a distance between an image of the distribution of elementary elasticity moduli, by a Finite Element Model, and the axial displacement field, and

a system for regularizing the solution of the estimator by means of a diagonal matrix (R) whose coefficients (α_{ii}) are functions of the axial displacements (d_i) and are applied to respective elementary elasticity moduli (e_i).

5. An apparatus as claimed in claim **4** further comprising an electronic system for calculating the elasticity modulus estimator by utilizing a matrix (M) formulated as:

$$M=[S^TS+R]^{-1}S^T,$$

where R is the diagonal regularization matrix and where S is a sensitivity matrix which is a function of the axial displacements, and for performing a matrix multiplication of said matrix (M) by the displacement field vector (d).

6. An apparatus as claimed in claim **5**, further comprising an electronic system for the processing of the echographic signals emitted and received by the probe in order to perform a 1-bit temporal correlation of these signals and to produce a field of axial displacements in the soft tissue subjected to the axial external compression.

7. An apparatus as claimed in claim **6** wherein the probe is an array of linear detectors emitting recurrent excitation signals.

8. An apparatus as claimed in claim **4** further comprising:

a system for the formation of echographic images in order to compose medical images on the basis of echographic signals, and

an image display system for displaying medical images of the tissue, and for displaying images of the measurements of variations of displacements of the tissue subjected to the continuously variable compression, and for reconstructing images of the distribution of the elasticity modulus in the tissue in order to visualize the elasticity variations in the tissue.

9. An apparatus as claimed in claim **8** wherein the soft tissue comprises tumors, the tumors being associated with the zones of the reconstruction images of the elasticity modulus presenting a contrast of the elasticity variations.

10. An apparatus as claimed in claim **9**, wherein the tumors comprise breast cancer, wherein the compressor is provided with means for compressing the breast while applying a radial pressure to a surface of the tissue while, another, parallel surface of the tissue serves as a reference for the radial displacements.

11. An apparatus as claimed in claim **5** further comprising:

a system for the formation of echographic images in order to compose medical images on the basis of echographic signals, and

an image display system for displaying medical images of the tissue, and for displaying images of the measurements of variations of displacements of the tissue subjected to the continuously variable compression, and for reconstructing images of the distribution of the elasticity modulus in the tissue in order to visualize the elasticity variations in the tissue.

12. An apparatus as claimed in claim **6** further comprising:

a system for the formation of echographic images in order to compose medical images on the basis of echographic signals, and

an image display system for displaying medical images of the tissue, and for displaying images of the measurements of variations of displacements of the tissue subjected to the continuously variable compression, and for reconstructing images of the distribution of the elasticity modulus in the tissue in order to visualize the elasticity variations in the tissue.

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