$$e^T R\underline{e} = \alpha_1 e_1^2 + \alpha_2 e_2^2 + \ldots \alpha_i e_i^2 \ldots + \alpha_n e_n^2 = \sum_{i=1}^{i=n} \alpha_i e_i^2 \quad (7b)$$

This relation (7b) expresses that the diagonal elements of the matrix R constitute the coefficients α_i which are applied to all of the respective elements e_i of the elasticity modulus vector $\underline{e}$.

Referring to FIG. **2**, the invention proposes an electronic system **200** which is associated with the echography apparatus and can operate in real time in order to carry out an attractive method of determining said coefficients α_i so as to form coefficients or weights to be applied to the elements e_i. The system **200** executes:

- a step **210** for the acquisition of the displacement field or displacement vector $\underline{d}$ by 1-bit temporal correlation of the RF signals transmitted by the probe;
- a step **220** for estimating the elasticity modulus vector $\underline{e}$ which includes:
- an operation **221** for calculating the sensitivity matrix S as is known, for example from the cited publication;
- an operation **222** for calculating the regularization matrix R, including:
- a sub-operation for truncated decomposition of the sensitivity matrix S into single values. It will be recalled that the operation for the decomposition of a matrix into single values consists in writing the relevant matrix on a base of real vectors as is known to those skilled in the art. Such a decomposition defines new matrices with a change of reference matrix V and a diagonal matrix Δ formed by elements δ_{ii}. According to the invention, the truncation level for performing the truncated decomposition has been empirically determined and has been found to be preferably of the order of from 0.2 to 10%. The diagonal matrix Δ is used to construct a new diagonal matrix K whose diagonal elements are calculated in conformity with the following formule (11a):

$$K_{ii}=(\Delta_{ii}/cte))-\Delta_{ii}^2 \quad (11a)$$

- a sub-operation for the actual calculation of the regularization matrix R according to the invention, being a diagonal matrix whose diagonal elements α_{ii}, also called α_i, are the diagonal elements of a matrix J which is not necessarily diagonal and is obtained by way of the following formula (11b):

$$J=VKV^T \quad (11b)$$

According to the invention, the regularization term smoothes the distribution of the elements of the elasticity modulus by means of a vector which is formed by diagonal coefficients of the matrix R, thus forcing given pixels of the image to have elements e_i which tend more strongly to zero than others. The regularization function according to the invention defines a uniform interval and forces each value e_i to remain within this interval which is centered around a specific mean value e_{Mi} of e_{ei}. Thus, the definition of the regularization matrix R according to the invention enables the vector, formed by distances from the mean value of e_i, to remain uniform. This regularization method enables a reconstructed image of the modulus distribution e of the object to be obtained by means of an estimator $\hat{e}$ of $\underline{e}$ whose sensitivity to noise is uniformly distributed between all the components e_i from e_l to e_n of $\underline{e}$. The diagonal coefficients of the regularization matrix R weight the respective elementary components e_i in a manner which is potentially different as a function of their location i. This method of regularization is very resistant to the noise. According to the invention, the uniform interval is defined and the regularization matrix R is derived from the sensitivity matrix S by simple matrix calculations (described above) which are performed in the system **200** as shown in FIG. **1**.

At the end of the operation **222** for calculating the matrix R, the electronic system **200** associated with the echography apparatus executes:

- an operation **223** for calculating the matrix M of the estimator of $\underline{e}$ on the basis of the relation (9b) in conformity with the relation:

$$M=[S^TS+R]^{-1}S^T \quad (10),$$

followed by an operation **224** for matrix multiplication of the matrix M by the vector $\underline{d}$.

According to the invention a single iteration suffices so as to obtain a reconstruction image of the elasticity modulus $\underline{e}$ on the basis of the displacement vector $\underline{d}$ while utilizing the method which is represented by the functional blocks in FIG. **1** and carried out by the electronic system **200** associated with the echography apparatus **10, 100** of FIG. **1**. The regularization term is thus applied to this single iteration. This results in the simple implementation of the invention as illustrated by FIG. **2** in association with FIG. **1**.

The FIGS. **4**, **5**A, **5**B and **6**A, **6**B illustrate the results obtained by means of the method according to the invention. These Figures can be displayed by means of a display system **6** which includes a monitor, and possibly recording means, associated with the echography apparatus **100**. This display system is, for example the same system as that enabling the display and recording of echographic images via the imaging system **120**.

FIG. **4** shows a discretized explored tissue zone having a width of 5 cm in the direction X and a thickness of 5 cm in the direction Z. The tissue contains two inclusions or inhomogeneities, resulting in variations of the elasticity modulus which are expressed as Σe in kilopascals and appear in the form of two regular reliefs.

FIGS. **5**A and **5**B are reconstructions utilizing the regularization matrix R according to the invention on the basis of displacement data determined by means of the echographic method illustrated by the FIGS. **1** and **2** for the variations δe of the elasticity modulus, using the same units, in the case where, moreover, the displacement data contains noise. FIG. **5**A has been formed for a signal-to-noise ratio equal to 50 and FIG. **5**B for a signal-to-noise ratio equal to 20.

The FIGS. **6**A and **6**B are reconstructions with the Tikhonov regularization term, realized in otherwise the same conditions as the FIGS. **5**A and **5**B.

Comparison of the homogeneous tissue zones between the inhomogeneities in the FIGS. **5**A and **6**A (signal-to-noise ratio equal to 50), reveals that the method according to the invention enables complete noise suppression in these zones, whereas these zones are very noisy when the Tikhonov regularization method is used.

As a result, the images reconstructed according to the invention have a better contrast and the elasticity variations due to inclusions or inhomogeneities of the tissue are better localized and more easily detected.

Moreover, comparison of the homogeneous tissue zones between the inhomogeneities in the FIGS. **5**B and **6**B (signal-to-noise ratio equal to 20) reveals that the method according to the invention still offers excellent contrast