Claims

1. A biological imaging system for determining a spatial distribution of one or more physical properties within a biological structure, the system comprising:

a data input arranged to receive a plurality of measurements relating to one or more physical fields; and

a processing device arranged to determine a spatial distribution of one or more physical properties within the biological structure using said plurality of measurements;

wherein the processing device is arranged to:

form a discretized full order model of the biological structure, the full order model comprising a first number of full order model coefficients;

determine a reduced order model of the biological structure, the reduced order model comprising a second, lower number of reduced order model coefficients;

determine optimised values for the reduced order model coefficients based on the plurality of measurements such that the reduced order model coefficients describe a baseline spatial distribution of the one or more physical properties within the biological structure;

form a hybrid model of the biological structure comprising the reduced order model coefficients and a set of full order model coefficients which describe a deviation from the baseline spatial distribution within the biological structure;

determine optimised values for the reduced order model coefficients and the full order model coefficients of the hybrid model based on the plurality of measurements; and

determine the spatial distribution of one or more physical properties within the biological structure using optimised values of the full order model coefficients and the reduced order model coefficients of the hybrid model.

2. The biological imaging system of claim 1, wherein the reduced order model coefficients describe a spatial distribution of the one or more physical properties within one or more expected uncertainty ranges associated with a healthy biological structure, and the full order model coefficients of the hybrid model describe one or more abnormalities in the biological structure that deviate from the expected uncertainty ranges.

3. The biological imaging system of claim 2, wherein the reduced order model coefficients describe an enhanced background of the biological structure that includes one or more regions in which the spatial distribution of the one or more physical properties departs from the expected uncertainty ranges.

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4. The biological imaging system of any preceding claim, wherein information regarding one or more sources of the field(s) is used when determining the spatial distribution.

5. The biological imaging system of claim 4, wherein the reduced order model and/or the hybrid model takes into account one or more uncertainties related to one or more sources of the physical fields.

6. The biological imaging system of any preceding claim, comprising one or more sources of the one or more physical fields that are measured and arranged to control the source(s) to provide specific stimuli to the biological structure.

7. The biological imaging system of any preceding claim, wherein the measurements relating to the one or more physical fields are performed in a plurality of different locations outside the biological structure.

8. The biological imaging system of any preceding claim, wherein determining optimised values for the reduced order model coefficients and/or the full order model coefficients comprises forming an objective function that depends on said coefficients, and finding values for the coefficients that cause the value of the objective function to approach or reach a goal.

9. The biological imaging system of any preceding claim, wherein the reduced order model coefficients are functions of one or more medium parameters which describe directly physical properties of the biological structure, and finding optimised values of the reduced order model coefficients comprises using the reduced order model coefficients as optimisation inputs.

10. The biological imaging system of any preceding claim, wherein the processing device is arranged, after only optimised values for the reduced order model coefficients have been determined, to compare an initial accuracy of the reduced order model to a final accuracy threshold, and if the initial accuracy is below the final accuracy threshold to determine the spatial distribution of the one or more physical properties within the biological structure using only the optimised reduced order model coefficients.

11. The biological imaging system of any preceding claim, wherein the full order model is built using a reference domain.

12. The biological imaging system of any preceding claim, wherein the processing device is arranged to determine optimised values for the first number of full order model coefficients based on the plurality of measurements such that the full order model describes an initial baseline spatial distribution of the one or more physical properties within the biological structure.

13. A computer implemented biological imaging method for determining a spatial distribution of one or more physical properties within a biological structure, the method comprising:

receiving a plurality of measurements relating to one or more physical fields;

forming a discretized full order model of the biological structure, the full order model comprising a first number of full order model coefficients;

determining a reduced order model of the biological structure, the reduced order model comprising a second, lower number of reduced order model coefficients;

determining optimised values for the reduced order model coefficients based on the plurality of measurements such that the reduced order model coefficients describe a baseline spatial distribution of the one or more physical properties within the biological structure;

forming a hybrid model of the biological structure comprising the reduced order model coefficients and a set of full order model coefficients which describe a deviation from the baseline spatial distribution within the biological structure;

determining optimised values for the reduced order model coefficients and the full order model coefficients of the hybrid model based on the plurality of measurements; and

determining the spatial distribution of one or more physical properties within the biological structure using the optimised values of the full order model coefficients and the reduced order model coefficients of the hybrid model.

14. A biological imaging system for determining a spatial distribution of one or more physical properties within a biological structure, the system comprising:

a data input arranged to receive a plurality of measurements relating to one or more physical fields; and

a processing device arranged to determine a spatial distribution of one or more physical properties within the biological structure using said plurality of measurements;

wherein the processing device is arranged to:

form a discretized full order model of the biological structure, the full order model comprising a first number of full order model coefficients;

use the full order model to describe a baseline spatial distribution of the biological structure, said baseline spatial distribution being described by a set of coefficients;

determine optimised values for the coefficients describing the baseline spatial distribution based on the plurality of measurements;

form a hybrid model of the biological structure comprising the baseline spatial distribution coefficients and a set of deviation full order model coefficients which describe a deviation from the baseline spatial distribution within the biological structure;

determine optimised values for the baseline spatial distribution coefficients and the deviation full order model coefficients of the hybrid model based on the plurality of measurements; and

determine the spatial distribution of one or more physical properties within the biological structure using optimised values of the deviation full order model coefficients and the baseline spatial distribution coefficients of the hybrid model.

15. The biological imaging system of claim 14, wherein the baseline spatial distribution of the biological structure is described by full order model coefficients and wherein the processing device is arranged to:

determine a reduced order model of the biological structure, the reduced order model comprising a second, lower number of reduced order model coefficients;

determine optimised values for the reduced order model coefficients based on the plurality of measurements such that the reduced order model coefficients describe a baseline spatial distribution of the one or more physical properties within the biological structure; and

use the reduced order model coefficients which describe the baseline spatial distribution to determine the full order model coefficients which describe the baseline spatial distribution.