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(54) NON-UNIFORM EXCITATION FIELD-BASED METHOD AND SYSTEM FOR PERFORMING MAGNETIC NANOPARTICLE IMAGING

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(58) Field of Classification Search

None

See application file for complete search history.

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(57) ABSTRACT

The present disclosure belongs to a field of biomedical imaging technology, and in particularly to a non-uniform excitation field-based method and system for performing a magnetic nanoparticle imaging. The present disclosure includes: separating the non-uniform excitation field into independent space and current time functions by a spatialtemporal separation method; calculating a normalized signal peak through the current time function; constructing a reconstruction mathematical model based on the normalized signal peak and an imaging subunit volume; and quantitatively reconstructing a spatial distribution of a nanoparticle by combining the normalized signal peak, a nonuniform spatial function of the excitation field and the reconstruction mathematical model, so as to achieve the magnetic nanoparticle imaging of a to-be-reconstructed object.

10 Claims, 2 Drawing Sheets

A spatiotemporal separation processing is performed on a non-uniform excitation field $H_{\mathcal{E}}(r,t)$, so that the non-uniform excitation field is divided into an independent spatial function $A_0(r)$ and an independent time function $I_E(t)$, that is, $H_E(r,t) = A_0(r)I_E(t)$ A sensitivity spatial function $p_R(r)$ of a receiving coil is acquired An excitation current $I_{E}(t)$ is introduced into an excitation coil to generate a required non-uniform excitation field in an imaging space, so as to excite a magnetic nanoparticle in a space A magnetic nanoparticle response voltage signal $u_p(t)$ is detected using a receiving coil in real time, and then a normalized magnetic nanoparticle signal $s(t) = u_v(t)/[I_E(t)]^k$ is calculated A gridding processing is performed on an imaging space to be divided into N imaging subunits A peak s_p of the normalized magnetic nanoparticle signal s(t) is calculated A reconstruction equation of the normalized signal peak s_p and a magnetic nanoparticle spatial distribution $c(r_n)$ is established The nanoparticle spatial distribution $c(r_n)$ is reconstructed using the above equation and the the normalized signal peak $s_{\mathfrak{p}}$, so as to achieve a magnetic

nanoparticle imaging of a to-be-reconstructed object