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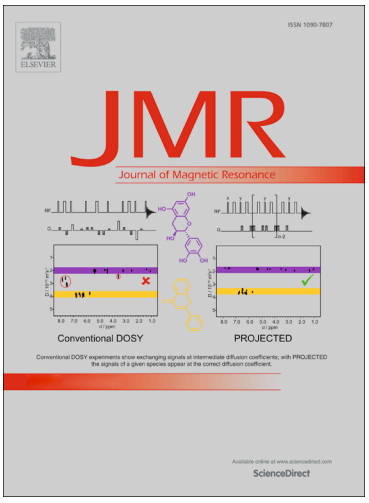

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Design of a shielded coil element of a matrix gradient coil

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Abstract

The increasing interest in spatial encoding with non-linear magnetic fields has intensified the need for coils that generates such fields. Matrix coils consisting of multiple coil elements appear to offer a high flexibility in generating customized encoding fields and are particularly promising for localized high resolution imaging applications. However, coil elements of existing matrix coils were primarily designed and constructed for better shimming and therefore are not expected to achieve an optimal performance for local spatial encoding. Moreover, eddy current properties of such coil elements were not fully explored. In this work, an optimization problem is formulated based on the requirement of local non-linear encoding and eddy current reduction that results in novel designs of coil elements for an actively-shielded matrix gradient coil. Two metrics are proposed to assess the performance of different coil element designs. The results are analysed to reveal new insights into coil element design.

Keywords: magnetic resonance imaging, gradient coil design, matrix coil, non-linear spatial encoding magnetic fields

1. Introduction

Spatial encoding with non-linear Spatial Encoding Magnetic fields (SEMs) has received increasing interest in the past few years. Among the performed work on this technique, the Patloc (Parallel Imaging Technique Using Localised Gradients) [1, 2] approach may be mentioned that includes higher-dimensional PatLoc trajectories such as

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