

Passive Tracking of the Devices during MR-guided Interventions

S.Patil¹, O. Bieri¹, K. Scheffler¹

¹Division of Radiological Physics, University of Basel Hospital, Basel
e-mail: oliver.bieri@unibas.ch

Introduction:

In endovascular MR-guided interventions, passive tracking of the surgical devices utilizing paramagnetic markers is a challenging task [1, 2]. In this work, we describe two novel methods that are based on morphing SSFP and echo-dephased SSFP generating positive contrast within close vicinity of the marker.

Material and Methods:

The basic template of morphing SSFP is based on SSFP-echo sequence. In combination with long TR, low flip angle and in the presence of local gradients induced by paramagnetic markers, the sequence morphs itself to a balanced SSFP sequence. The second novel method is based on inversion of the polarities of pre-phasing as well as dephasing gradients of the balanced SSFP sequence.

A custom-built phantom with 11 mm diameter tubes to model the blood flow in large vessels and to insert the guide wire was used. The tubes were immersed in a gadolinium (Gd)-doped water and were surrounded by a 2% agarose gel doped with 0.5 mM copper sulphate (CuSO_4) concentration to closely resemble the relaxation times of fat tissues. All the measurements were done on a Siemens Espree 1.5T scanner.

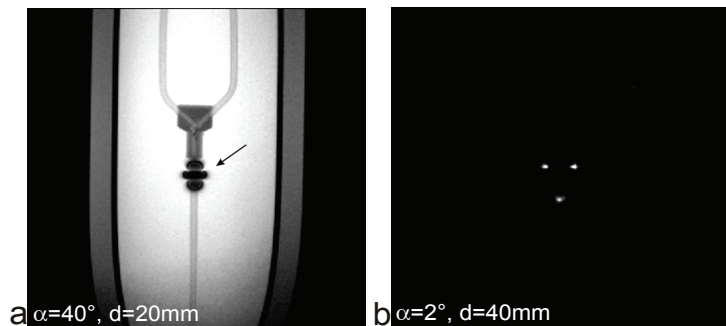


Figure 1: a) SSFP-echo image showing black void. b) Morphing SSFP image showing positive contrast within the vicinity of the marker

Results:

An image of the experimental set-up with a guidewire inserted in a tube is shown in Fig. 1a using SSFP-echo sequence. In this image signal loss due to field perturbations of the paramagnetic marker is clearly visible. Figure 1b shows the image obtained using morphing SSFP technique.

Figure 2a displays the localizer image using GRE sequence displaying black void due to marker. Figure 2b depicts the positive contrast within the close vicinity of the paramagnetic marker obtained using echo-dephased SSFP.

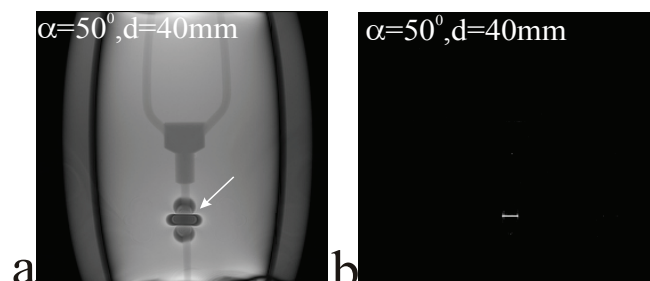


Figure 2: a) GRE image showing black void. b) Echo-dephased SSFP image showing positive contrast within the vicinity of the marker

Discussion:

We have given evidence, that the proposed new methods of morphing SSFP and echo-dephased SSFP is able to produce positive contrast from susceptibilities, while keeping a vanishing background signal. Both methods are promising new concepts for fast detection of positive contrast for passive tracking of interventional devices.

References:

- [1] Seppenwoolde et al., MRM 50:784-790, 2003.
- [2] Stuber et al., MRM 58:1072-1077, 2007.