

AbstractID: 3005 Title: A Novel Simulated Method of Quantifying Susceptibilities in Objects: The First Step toward Quantitative Diagnosis in MRI

Quantifying tissue susceptibilities *in-vivo* is important because certain tissue susceptibilities may reflect health conditions of an individual. Many researchers have accurately measured susceptibilities of different materials using the least-square-fit method when the object sizes occupy at least 50 pixels on MRI. In this abstract we have developed a new approach to measure susceptibilities of small objects from MRI.

We first simulated a disk with a radius of 16 pixels on 4096×4096 magnitude and phase images. The disk was a cross section of an infinite tube, perpendicular to the main magnetic field in MRI. The magnitude inside the disk was zero but unity outside the disk. The echo time and the field strength were chosen as 5ms and 1.5T. The phase was then simulated according to the well-known physics laws in magnetostatics, with a -9ppm susceptibility difference inside and outside the tube. Through a low-pass k-space filter, the sizes of images were then converted to 256×256 such that the radius of the disk became roughly 1 pixel. The 256×256 magnitude and phase images would be almost identical to images acquired from a 1.5T MR system, with an air tube of radius 1mm perpendicular to the magnetic field and surrounded by water.

Our images were simulated with different tube radii as well as with and without Gaussian noises. Two circles around the disk were drawn on images. The centers of these two circles were coincided with the center of the disk. With each circle, the complex signal was summed. We were able to solve the susceptibility from an inverse approach, based on the known disk sizes, the comparisons of the obtained complex sums, and a theoretical model.

Without the presence of noise, the solved susceptibilities were within 1% accuracy compared to -9ppm. With the presence of noise, the results are more complicated.