Incorporating Relaxivities to More Accurately Reconstruct Magnetic Resonance Images

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In MRI, the spatial frequency measurements are subject to the effects of transverse intra-acquisition decay, magnetic field inhomogeneities and longitudinal relaxation time, during data acquisition. Thus, the resulting image can include some artificial effects that result from these Fourier encoding anomalies. As such, the image-space data should be reconstructed from measured spatial frequencies using an inverse Fourier transform operator that accounts for the Fourier anomalies and care should be taken when drawing conclusions from the fMRI data. Nencka et al. [*Journal of Neuroscience Methods* 181 (2009) 268-282] developed the AMMUST (A Mathematical Model for Understanding the Statistical) framework for incorporating Fourier encoding anomalies. However, this framework does not account for the recovery of the longitudinal relaxation time, assuming a long repetition time, *TR*. As this assumption is not always valid, and the signal amplitude becomes dependent on the longitudinal relaxation time when performing fast repetitive excitations, the effect of the longitudinal relaxation time should also be considered in this setting. We expand upon the AMMUST framework to incorporate all the Fourier encoding anomalies in an effort to account for these effects. We also point out the misrepresentation of the incorporation of the transverse intra-acquisition decay and magnetic field inhomogeneities in this previous study. The exact image-space means and correlations are theoretically and experimentally computed by implementing the AMMUST linear framework, adapted to incorporate intra-acquisition decay, magnetic field inhomogeneities and longitudinal relaxation time.