Bioengineering 278: Magnetic Resonance Imaging Laboratory
Winter 2011
Lab 7

The goal of this week is to build and test a simple 4 rung birdcage coil.

1. Build and tune a 4 rung birdcage coil with the help of the instructor and TA. Use the coil to image a phantom with the two feed points in quadrature and anti-quadrature. (10 points).
2. Calculate the expected field profile across the mid-axial plane for an ideal 4 rung birdcage, assuming infinite length rungs, and ignoring wavelength effects. Assume that the two modes of the coil are fed with unit current, 90° out of phase, such that the current in mode a is sin(ωt) and the current in mode b is cos(ωt). Calculate the fields from each of the modes across the axial plane. At each point, the field will be described by Asin(ωt)+B cos(ωt), where A and B are complex coefficients that describe the contributions to the field from modes a and b. The phase angle of A and B describe the direction of the fields. The field that contributes to the MR signal is that which is rotating with the spins at the Larmor frequency. To find this, decompose the field into $Ce^{i\omega t} + De^{-i\omega t}$, where C and D are again complex coefficients, and describe the rotating and counter-rotating parts of the field. Plot the magnitude and phase of C and D separately, as they should describe the response of the coil with cables connected correctly, and backwards, respectively. Repeat this calculation for the two pairs of modes shown below. These are two ways of decomposing the coil into two modes. Are they equivalent (ie if you drove the coil using these two decompositions, would you get the same image, apart from a 45° phase shift)? (10 points)