References are to equations appearing in the course book.

Problem 8.1

Assume that the slice select gradient amplitudes are changed from those shown in Fig. 10.11 to be $G_{0x} = -G_{0y} = 2G_{0z}$. What are the angles Φ and Θ of the resulting slice? Draw the excited plane (use Fig. 10.10 as a guide).

Problem 8.2

Given the following imaging parameters, determine T_{acq} in each case.

a) Find T_{acq} for a 2D spatial imaging experiment with $N_y = 256$ and $T_R = 1200\,\text{ms}$.

b) Find T_{acq} for a 2D spatial 1D spectral CSI experiment with $N_x = N_y = 256$ and $T_R = 1200\,\text{ms}$.

c) Find T_{acq} for a 3D spatial imaging experiment with $N_x = N_y = 256$, $N_z = 128$ and $T_R = 1200\,\text{ms}$.

d) Find T_{acq} for a 4D imaging experiment with $N_x = N_y = N_z = 16$ and $T_R = 1200\,\text{ms}$.

e) Discuss the implications of your result to the imaging of humans. Assume it is difficult for an average patient to stay in the imaging environment (lying still inside the bore of a magnet) for more than 30 minutes without becoming uncomfortable. Usually 10 minutes is assumed to be an upper limit for a single MRI scan. Assume also that you are imaging the entire human head which requires about 19.2 cm (left-to-right) × 25.6 cm (head-to-foot with oversampling) × 22.4 cm (front-to-back) of total spatial coverage. Given that the spatial resolution, as defined later in Ch. 13, is the ratio of FOV (the area over which the image is acquired) to number of encoded points, discuss the trade-off in spatial resolution versus imaging time in going from part (c) to part (d).