References are to equations appearing in the course book.

Problem 5.1

Consider the situation in Fig. 7.2c where the coil lies in the x-y plane and a spatially independent field rotates about the x-axis:

$$\vec{B}(t) = -B\sin(\omega t)\hat{z} + B\cos(\omega t)\hat{y}$$

Show that the *emf* induced in the coil is $L^2 B\omega\cos(\omega t)$.

Problem 5.2

Consider the signal resulting from two spin isochromats with identical spin densities but different frequencies of precession $\omega_a = \omega_0 + \Delta\omega$ and $\omega_b = \omega_0 - \Delta\omega$. The total signal for this experiment is just the linear addition of the signal from each isochromat. Find the demodulated signal (with zero offset, $\delta\omega = 0$) from the two-spin system and compare it to the demodulated signal (with offset) represented by (7.24) or (7.25).

Note: It will be evident in the solution that the signal from two spin isochromats with slightly different frequencies (a difference represented by a small $\Delta\omega$) exhibits beats. See the discussion on beating in Ch. 8.

The problems are based on those in Robert W. Brown, Y.-C. Norman Cheng, E. Mark Haacke, Michael R. Thompson, Ramesh Venkatesan. *Magnetic Resonance Imaging: Physical Principles and Sequence Design*, 2nd Edition, Wiley, 2014.