ELEC-E8736 Basics of MRI

Exam 9.4.2019

Not allowed to take the exam paper :(

1. Multiple choice questions

- What do μ and B mean in this equation?

$$\frac{d\vec{\mu}}{dt} = \gamma\vec{\mu} \times \vec{B}$$

- What is flip angle proportional to?

$$\Delta\theta = \gamma B_1 \tau$$

- What is flux?
- When does gradient echo appear?
- What is phase encoding?

2. Homework 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 $L^2 B\omega\cos(\omega t)$.

3. Homework problem (4.1)

The key equation (4.12) can be used to investigate general questions. If unmagnetized material is placed in a region with a finite static field at $t = 0$ ($M_z(0) = 0$):

Find the time it takes, in units of T_1, for the longitudinal magnetization to reach 85% of M_0.

4. Spin echo and T_2 measurement

a) $\pi/2$ RF pulse followed by a π pulse
b) $\pi/2$ RF pulse followed by multiple π pulses

5. 2D gradient echo imaging, the sequence diagram and gradients

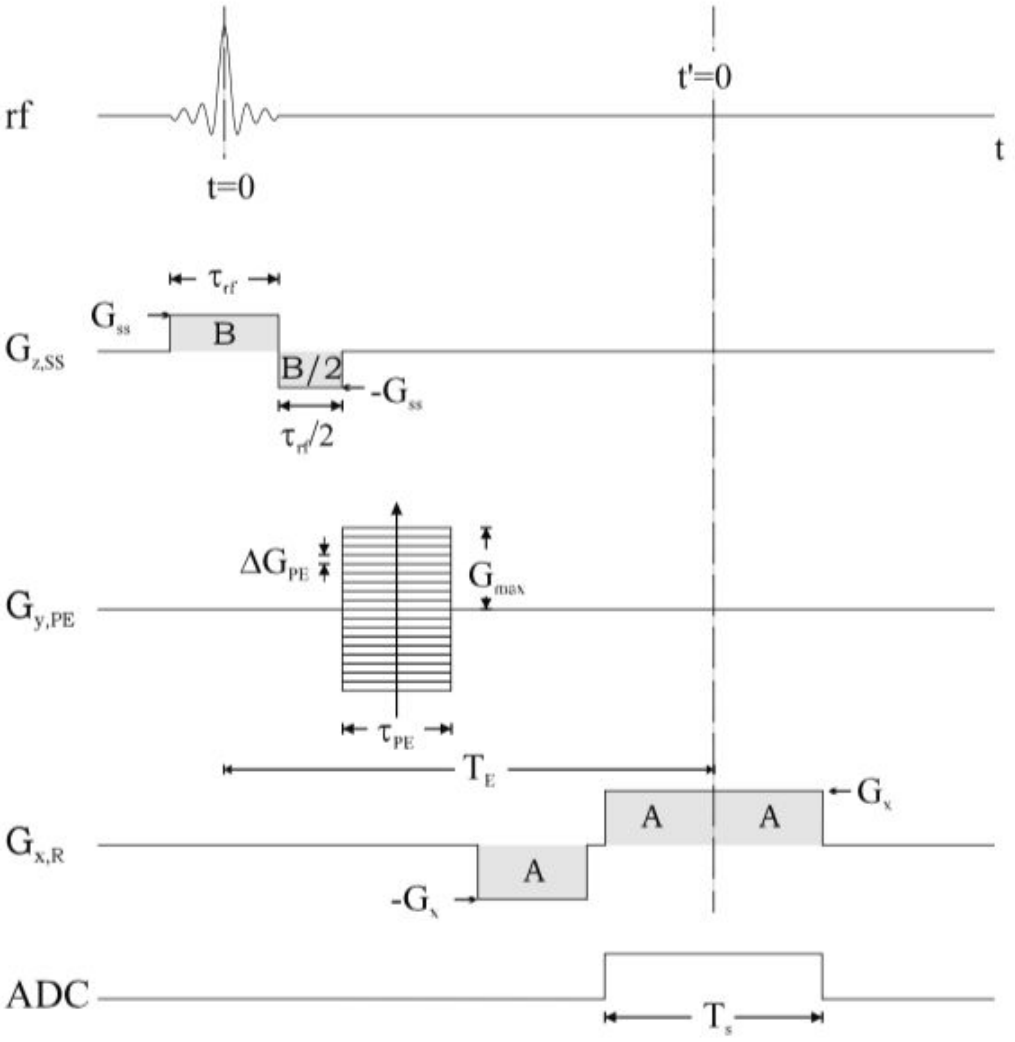

Fig. 10.13: Sequence diagram for a 2D gradient echo imaging sequence. The rf pulse is a sinc function in time, corresponding to a boxcar frequency spectrum. The design of the rephasing lobe of the slice select z-gradient is described in Sec. 10.2.2. The phase encoding y-gradient is pictured as a series of horizontal lines to denote that it is being stepped regularly through increasing values during different repetition periods. The x-gradient has the read gradient echo structure explained in Sec. 9.4. The symbols A, B, and $B/2$ refer to areas under the gradient lobes, and important timings and gradient strengths are also marked. Note that in this 2D sequence structure no gradients overlap each other in time, in contradistinction to the structure shown in Fig. 10.14.