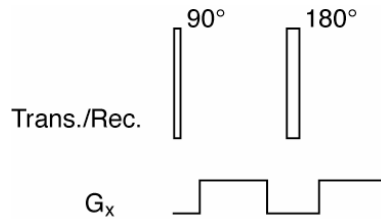


HW9

1. A typical gradient echo imaging experiment is conducted with multiple repetitions of the pulse sequence, using a recycle time TR . For a specimen with a fairly homogeneous $T1$ relaxation rate and TR of order $T1$, it is found that the image signal is maximized for an excitation pulse angle (called the “Ernst angle”) somewhat less than 90° . Determine the pulse angle that optimizes the gradient echo signal, in terms of arbitrary TR and $T1$.
2. Explain how the pulse sequence “module” shown below could act to suppress MRI signal from flowing but not static protons. Assume both pulses rotate magnetization in the same direction.



Show graphically what happens to the bulk magnetization vector throughout this sequence, and represent the effect of the pulse sequence in k -space. What effect would changing the amplitude of the gradient pulses have on the efficiency of flow suppression?