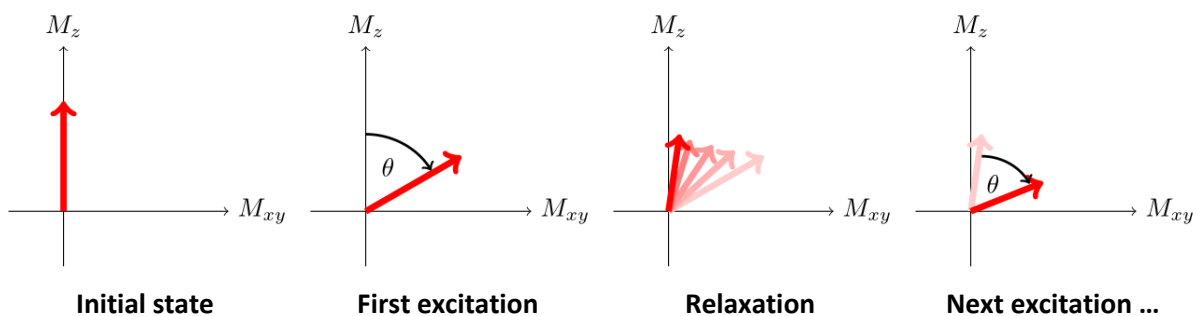


Exercises

1. Equilibrium Magnetization

- Calculate the relative difference $\frac{\Delta n}{n}$ in up- and down-state spin population for the common case of
 - Protons (^1H)
 - Body temperature (310 K)
 - 3T field strength

2. Magnetization Dynamics



- Write a Matlab program that simulates and visualizes repeated on-resonance excitation of nuclear magnetization at one point
 - perform equal excitations of given flip angle θ at a given repetition time T_R
 - assume excitation to be an instantaneous rotation by θ . Excitation is on-resonance, so all rotations are about the same axis.
 - consider the fact that relaxation between excitations is incomplete
 - vary T_1 , T_2 and the flip angle. Study the magnetization behaviour. What happens in the course of long pulse series?
- Repeated excitation leads into periodic magnetization dynamics. Assuming complete transverse relaxation per interval, which flip angle yields maximum transverse magnetization in the periodic regime? Calculate analytically for given T_1 and T_R .
- Verify your solution with your simulation code