Fachbereich
Angewandte Naturwissenschaften
Studiengang: Biomedizintechnik

Bachelor Thesis

Title: Development of a Control System for Digital Benchtop Nuclear Magnetic Resonance (NMR) Spectrometer

Summary

Nuclear Magnetic Resonance (NMR) spectroscopy is an analytical technique with wide-ranging applications, from chemistry and medicine to materials science. Traditional NMR systems are often complex and costly, prompting the need for more accessible, benchtop alternatives. This thesis introduces an advanced control system specifically tailored for digital benchtop NMR instruments, designed to streamline user interaction and enhance data collection capabilities. The system operates within an STM32 microcontroller and PuTTY terminal software environment, ensuring seamless hardware-software integration. STM32F411RE microcontroller communicates with a Hameg power supply to regulate the current supplied to the NMR device. By finely tuning this current through a custom algorithm, the system manipulates the magnetic field to achieve optimal resonance conditions. Resonance signals are monitored in real-time via an oscilloscope and analyzed by a closed-loop control mechanism, significantly enhancing the reliability and accuracy of NMR measurements. A user-friendly terminal interface facilitates command input and real-time status updates. The project unifies advancements in user interface design, magnetic field current regulation, and real-time adaptive systems. The system is designed with the intent of achieving reliable resonance detection and adjustment, aiming to modify NMR experimentation and foster new avenues in applications and research.

Author: Manju Subedi
Supervisor: Prof. Dr. sci. nat. Max Urban
Date of Submission: 30.11.2023