Experimental Setup Documentation

Overview

This document provides detailed information about the **experimental setup** used in the *"Cellular Vibration Analysis using Atomic Force Microscopy (AFM)"* project.

AFM Model

The AFM used in this project is the NanoWizard 5 from Bruker BioAFM.

Signal Acquisition

The Atomic Force Microscope (AFM) operates by scanning a sharp tip (attached to a cantilever) across a sample. As the tip interacts with the surface, forces between the tip and the sample cause the cantilever to deflect. The deflection is typically measured in two directions: "Lateral Deflection" and "Vertical Deflection.".

The signals are transmitted into a Low-Noise Preamplifier "SR560" from Stanford Research Systems. There are two SR560 units, one for the lateral deflection and another for the vertical deflection. The SR560 serves both as a filter and amplifier, enhancing the quality of the signals.

The SR560 voltage preamplifier provides the following functionalities. (https://www.thinksrs.com/products/sr560.htm):

- Input Noise: 4 nV/$\sqrt{\text{Hz}}$
- Bandwidth: 1 MHz
- Variable Gain: 1 to 50,000
- AC or DC Coupled
- Two Configurable Signal Filters
- Differential and Single-Ended Inputs
- Line or Battery Operation
- RS-232 Interface

Data Acquisition

The conditioned signals from the SR560 units are then transmitted into a high-density NI PXI-5105 oscilloscope for data acquisition. The PXI-5105 allows for detailed analysis of the signals by using the LabView software installed in the computer, capturing the dynamic behavior of the cantilever during scanning.

Specifications of PXI-5105

- 60 MHz bandwidth
- 8 channels
- 12-bit resolution
- Sample rate: Up to 60 MS/s