Exercise Session: Station 2
Signal Acquisition and Analysis with PicoScope 2000 Series

Objective

The objective of this exercise is to learn how to use the PicoScope 2000 series USB oscilloscope and its built-in Arbitrary Waveform Generator (AWG). Students will try to understand the limits of your oscilloscope. Students will generate a signal using the AWG output and acquire the same signal using one of the input channels. The aim is to average multiple signal acquisitions to compute the mean signal waveform and its standard deviation, and then perform little exercises on the characteristics of the Picoscope.

Required Software

To perform this experiment, students must install the **PicoScope** software on their computer. This software allows full control and visualization of the PicoScope device.

- Download the PicoScope software from the official Pico Technology website: `https://www.picotech.com/downloads`
- Choose the version appropriate for your operating system (Windows, macOS, or Linux).
- Follow the installation instructions provided on the website.

Equipment

- PicoScope 2000 Series Oscilloscope

Procedure

1. Connect the PicoScope 2000 series device to your computer using the USB cable.
2. Open the PicoScope software and verify that the device is recognized.
3. Configure the AWG output to generate a signal (e.g., sine, square, or custom waveform).
4. Connect the AWG output to one of the input channels using a BNC cable.
5. Set up the software to acquire the signal on the selected channel.
6. Use the averaging feature in PicoScope to acquire multiple waveforms and compute the mean and standard deviation.
7. Save the resulting waveforms and measurements for analysis.

Exercises

- Generate a sine wave and use averaging to reduce noise. Compare single-shot and averaged signals.
- Sweep the frequency from 100 Hz to 1 MHz and record the amplitude response.
- Create and upload a custom waveform. Verify its shape on the input channel.
- Generate a square wave and measure the time delay between two channels.
- Zoom in on a square wave edge and measure rise and fall times.

→ **What are the limits of your system for data aquisition and processing?**

Advanced Exercises (Optional)

- Export signal data to CSV and analyze in Python (mean, std, histogram).
- Use the PicoSDK Python API to automate acquisition and saving.
- Perform FFT in Python to analyze the frequency content of a noisy signal.
- Compare multiple signal captures using Python for statistical analysis.
- Build a live viewer in Python with basic metrics using PyQtGraph.

Additional Resources

If you need help using the PicoScope software or understanding signal averaging concepts, the following resources may be helpful:

- Pico Technology Support: `https://www.picotech.com/support`
- PicoScope 6 User's Guide: `https://www.picotech.com/download/manuals/picoscope-6-user-guide.pdf`
- YouTube tutorials on using PicoScope: `https://www.youtube.com/user/PicoTechnology`