# Workshop 2
# Implementing an FPGA-based Digital Servo by Upgrading an Open-Source Product to the Newest FPGA Board: Challenges and Considerations

Tuesday September 9, 15:00-16:00, Room: ?

**Organizer:**
Seigen Nakasone, OIST (Okinawa Institute of Science and Technology)

**Statement of Objectives:**
Quantum physics experiments use and rely heavily on control instruments such as digital servos. To implement an FPGA-based high-speed low-noise digital servo, knowledges are necessary in control theories, signal processing, analog and digital electronics (hardware), FPGA programming (firmware), API and GUI developing (software). Good examples will lower the learning curve.

We have upgraded a digital servo open-sourced by NIST (the National Institute of Standards and Technology at the U.S.), migrated it from using Xilinx Spartan-6 board to Artix-7 board. Some modifications have been applied to its hardware and firmware to solve the compatibility issues. Software (API and GUI) is rewritten in Python for our special needs.

This workshop shares experience of the migration. The difficulties, pitfalls, considerations, and solutions will be introduced. What can be learn from the experience also applies to designing and implementing a new instrument.

**Acknowledgment:**
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**Intended Audience:**
Control researchers and engineers, especially who want to design and implement instruments for real world production.

**Speaker:** Seigen Nakasone, OIST.

Seigen Nakasone received the B.E. in Automation Control and M.E. degrees in Computer Science and Technology from Tsinghua University. Experienced several different careers, now working as a research unit technician in Experimental Quantum Information Physics Unit, OIST, developing instruments to support the quantum physics experiments.

**Program:** 15:00-16:00

1. Introduction to the digital servo open-sourced by NIST
    1. Overview
    2. ADC channels
    3. DAC channels
    4. Controller
    5. Flexibility in Use (Programmable Settings)
2. Needs Requirements for Upgrading
    1. XEM6010 (Xilinx Spartan6 based) end of life
    2. XEM7010 (Xilinx Artix7 based) incompatible
    3. Issues to deal with
3. Hardware and firmware modifications
    1. PCB modifications
    2. Firmware modifications
    3. PCB re-modifications (to match the new firmware)
4. Software
    1. API
    2. GUI
5. Bug locating and fixing tips
6. Application example (Project “Ion trap cavity lock”)
7. Bring home messages