Digital Control System

- MECH 421 -

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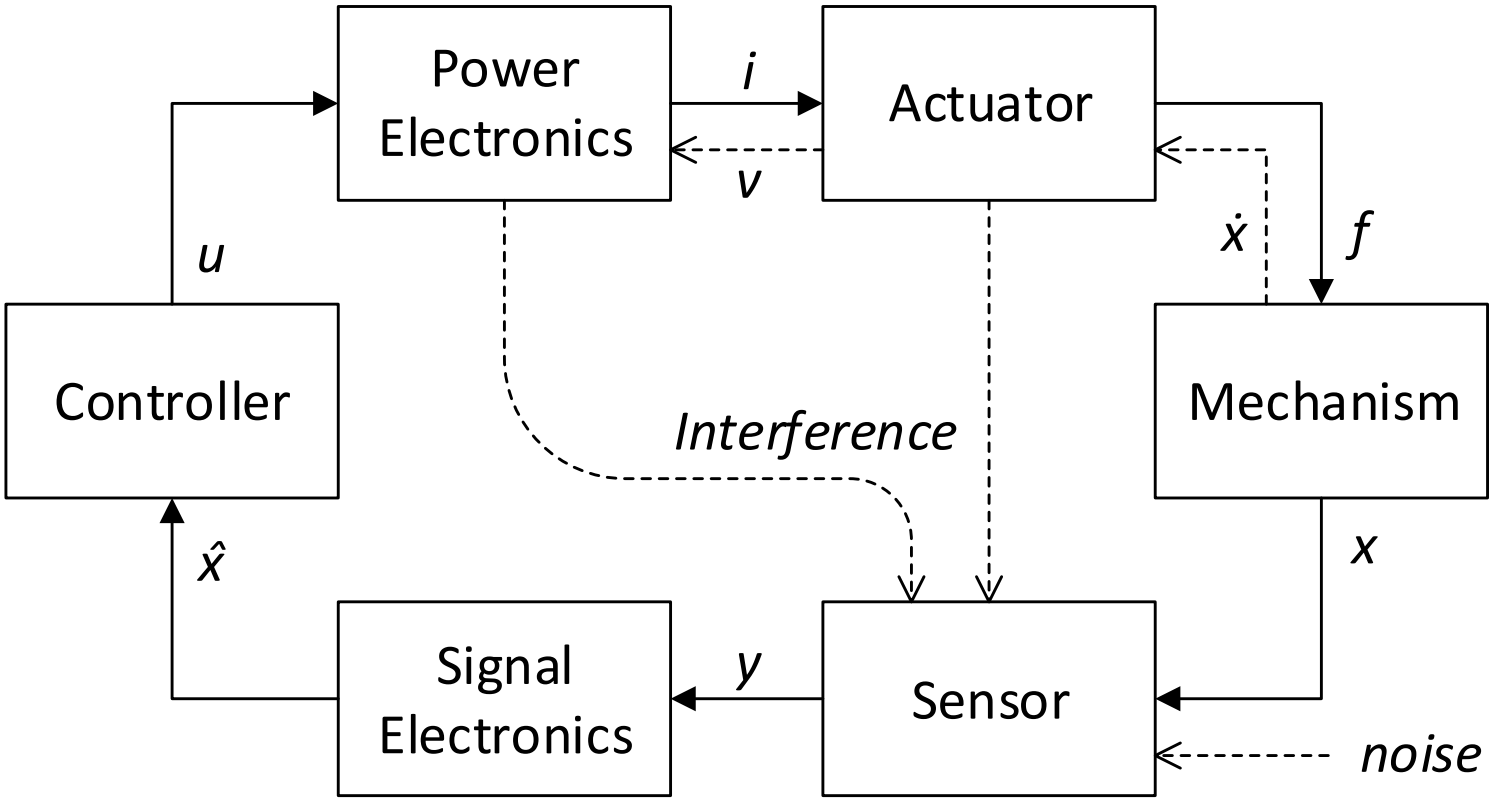
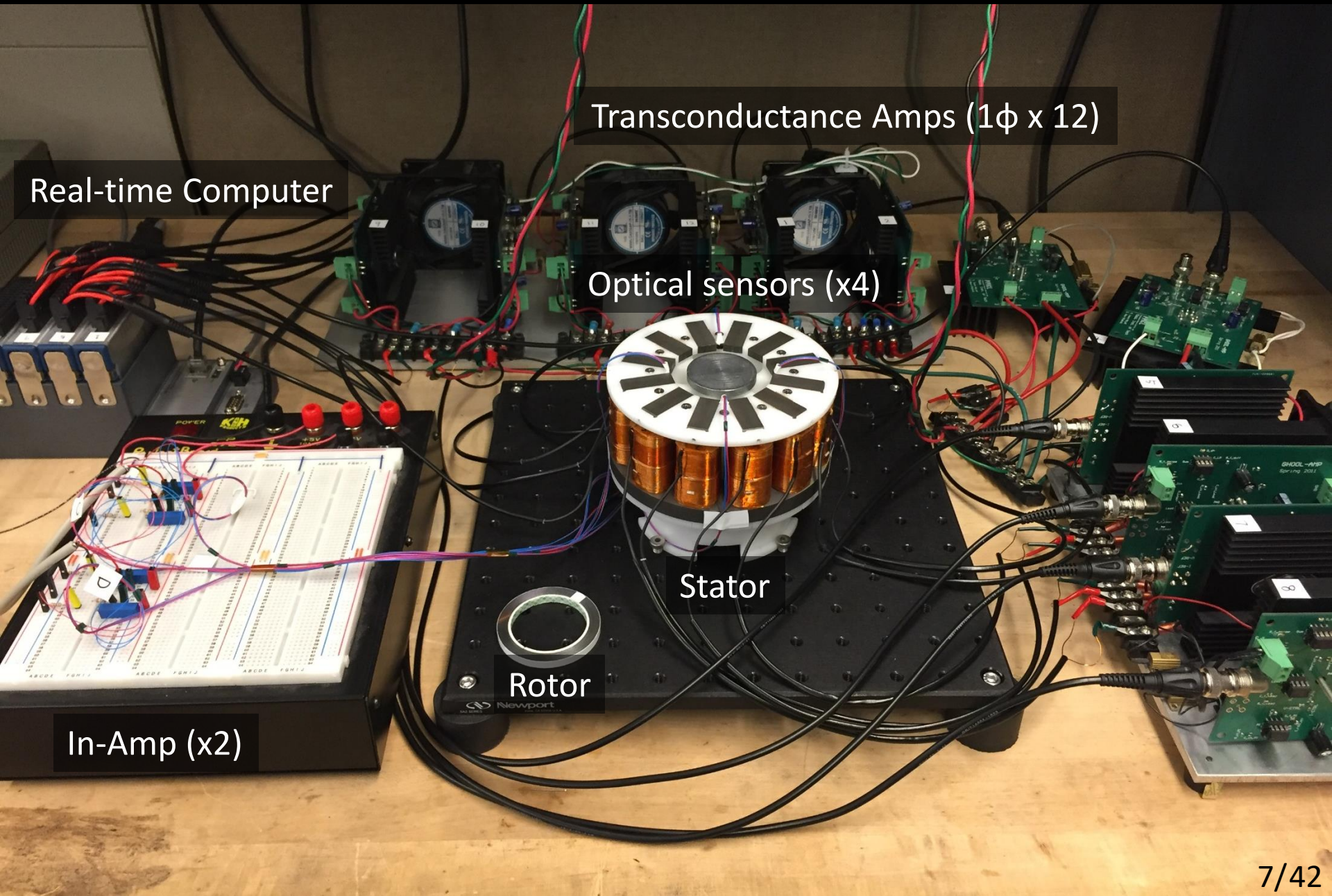
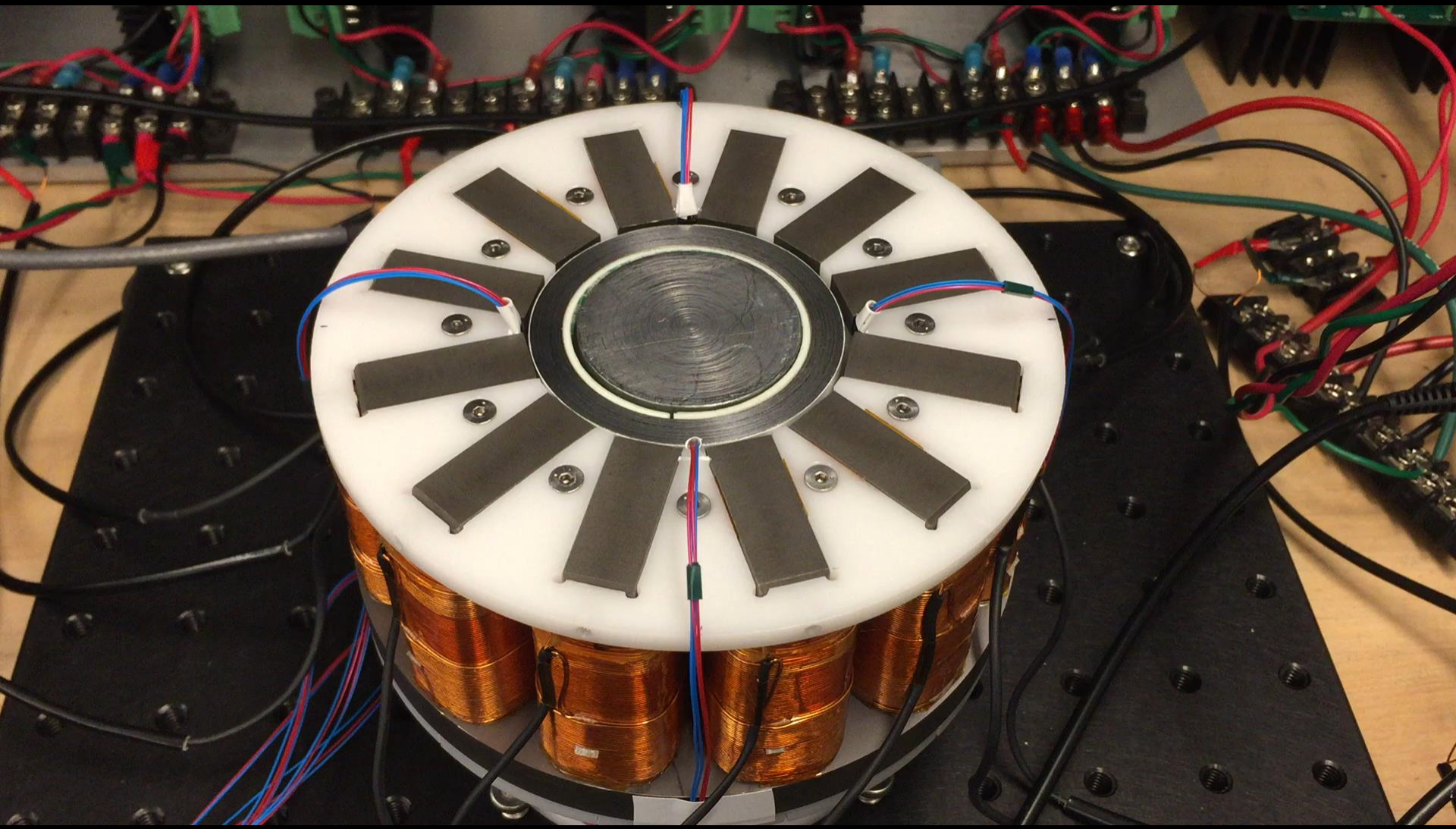
Mechatronic System



Bearingless Motor

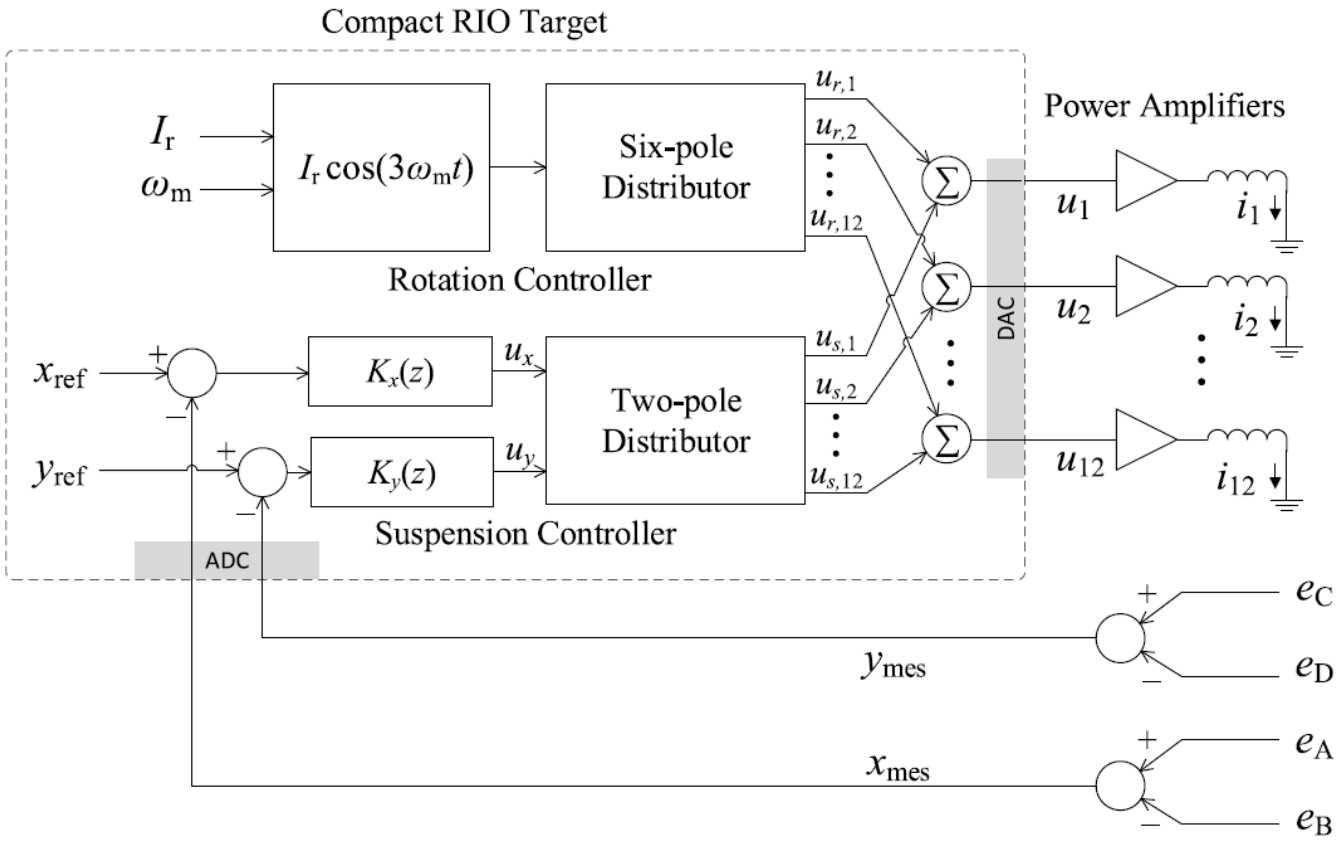


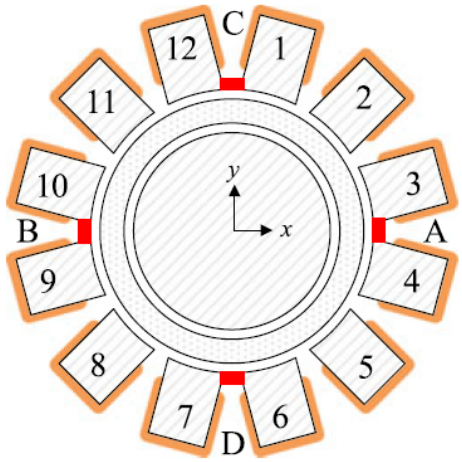
Levitation Test



- M. Noh *et al.*, *IEEE/ASME Transactions on Mechatronics,* Oct. 2017.
- M. Noh *et al.*, in *Proc. 15th International Symposium on Magnetic Bearings*, Aug. 2016.
- M. Noh and D. L. Trumper, U.S. Patent, Jan. 2019.

Control System





Six-pole Distributor

$$u_{r,n} = I_r \cos(3\phi_0 n - 3\Omega_r t) \qquad n \in \{1, \dots, 12\}$$

$$\phi_0 = 2\pi/12$$

Two-pole Distributor

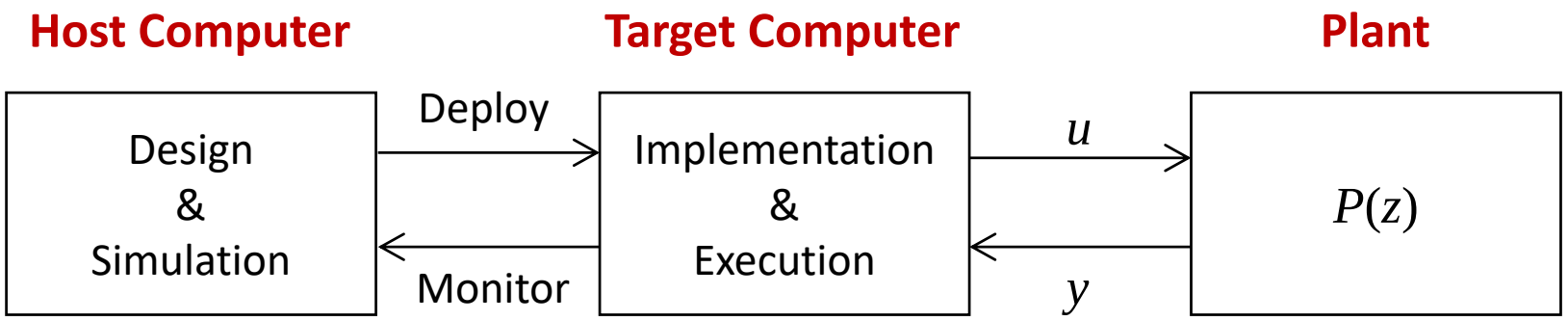
$$u_{s,n} = u_x \cos(\phi_0 n - \frac{\pi}{12}) + u_y \sin(\phi_0 n - \frac{\pi}{12})$$

Lead Compensators

$$K_x(z) = K_y(z) = K_p \frac{z - b_0}{z - a_0}$$

$$(K_p = 7,\ a_0 = 0.5219,\ b_0 = 0.9391)$$

System Architecture



Non real-time OS
(e.g., Linux, Windows)

Real-time OS, or without OS
(e.g., RT Linux, RT Windows, FreeRTOS)

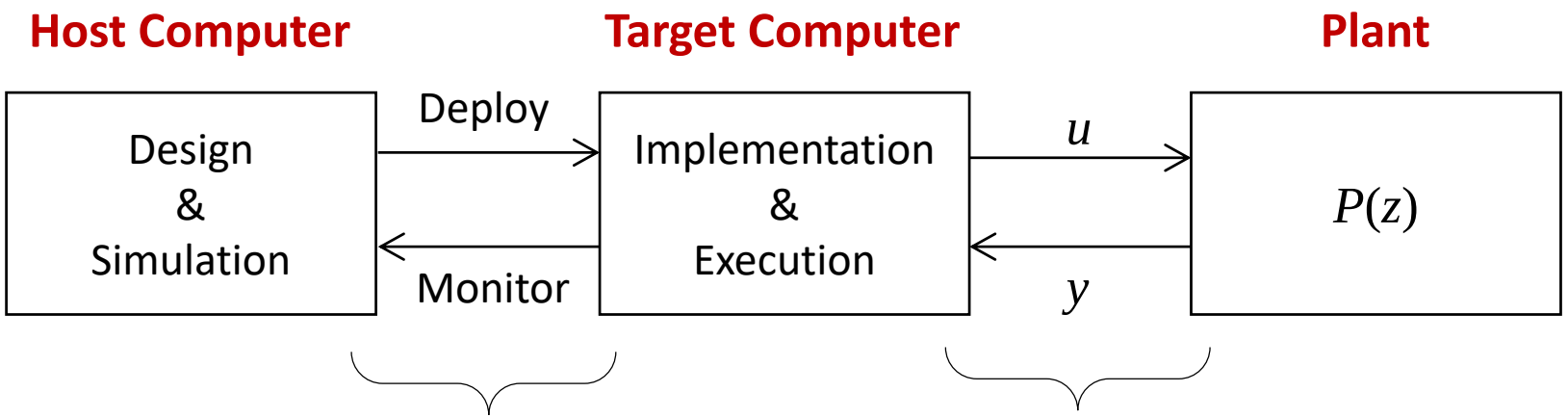
Other names

- Real-time controller, real-time target, controller, etc.

Examples

- Industrial PC
- Programmable Automation controller (PAC)
- Programmable logic controller (PLC)
- Microcontroller / DSP / FPGA

System Architecture



Non-deterministic communication

- Ethernet, USB, WiFi, etc

Deterministic communication

- Analog: ADC/DAC
- Digital: PWM, EtherCAT, SPI, I2C