**Lab 02 – Repetitive Control and Iterative Learning Control**

In this assignment, we will apply RC and ILC such that y(k), the output of the galvanometer, tracks r(k), a 400 Hz triangular wave with an amplitude of 1 degree and duration of 2 seconds.

1. [RC] Using the control block diagram shown in Fig. 5 of [1], DAVI (*Design, Analyze, verify, Implement*) a repetitive controller **Cr(z)** to track r(k). You may apply the ZPETC for constructing the stabilizing controller **F(z)**; **Q(z)** shall be a zero-phase low pass filter that improves the robustness of closed-loop stability.
2. [ILC] DAVI an iterative learning controller using the following updating law,
$$u_{j+1}(k) = \boldsymbol{Q}(\boldsymbol{z})\big[u_j(k) + \boldsymbol{L}(\boldsymbol{z})\big(r(k) - y_j(k)\big)\big].$$
You may apply the ZPETC for constructing the learning filter **L(z)**. **Q(z)** shall be a zero-phase low pass filter that improves the robustness of ILC convergence. Note that r(k) may need some zero-padding.
3. Compare the results from 1 and 2 with open-loop tracking (i.e., assign u(k)=r(k)). Hand in a written report that includes the discussion made on your results.

**Reference**

[1] L. W. Shih and C. W. Chen, "Model-Free Repetitive Control Design and Implementation for Dynamical Galvanometer-Based Raster Scanning," *Control Engineering Practice*, 122, p. 105124, 2022.
[2] M. Tomizuka, "Zero phase error tracking algorithm for digital control," *Journal of Dynamic Systems, Measurement, and Control*, 109, pp. 65-68, 1987.