# Iterative Learning Control and Repetitive Control

## IFAC World Congress 2020 Open Invited Session
## session code: 8a867

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**Abstract:** Iterative Learning Control (ILC) and Repetitive Control enable improved tracking performance by updating the control input using measured signals from previous tasks. Several frameworks have been developed, and these can be applied to a wide range of engineering systems that operate repeatedly on the same trajectory, especially in manufacturing, robotics, data storage systems, process control, etc. The aim of this session is to bring together researchers working on different frameworks, addressing theoretical advances and/or new and nontraditional application areas.

*Keywords:* Iterative learning control, autotuning, iterative modelling and control design, learning control, iterative methods, control applications, convergence analysis, iterative improvement

## 1. TECHNICAL COMMITTEES

This open invited session proposal is connected to the following TCs:

- (primary) TC 1.2 Adaptive and Learning Systems
- (secondary) TC 4.2 Mechatronic Systems

## 2. INTRODUCTION

Iterative Learning Control (ILC) and Repetitive Control enable improved tracking performance on repeated trajectories by updating the control on each iteration using tracking signals from the previous iterations with very fast convergence and guaranteed safe and robust way, see https://youtu.be/kj_ouy1Fnko for an illustrative animation. Several frameworks have been developed, and these can be applied to a wide range of engineering systems that operate repeatedly on the same trajectory or a class of trajectories, especially in manufacturing, robotics, data storage systems, process control, energy systems, etc. The research on these techniques and their applications have world-wide interest, and the primary goal of the session is to bring together these researchers and engineers working on different frameworks, addressing either new theoretical challenges and/or new application areas and results.

After several decades of development in the field, several dominant design paradigms have emerged and many successful applications have been reported. The aim of this session is to

- bring together papers representing these dominant paradigms, including linear repetitive process design, internal model design, norm-optimal design, frequency-domain design, and nonlinear ILC;
- address new theoretical challenges in ILC and repetitive control, including robustness, flexibility to varying tasks, as well as their connection and comparison to alternative learning-based control approaches; and
- present new emerging and nontraditional applications.

Since 2009, the current track proposers have organised ILC and repetitive control invited sessions at a large number of American Control Conference (ACC), Conference on Decision and Control (CDC), as well as an open invited track and a workshop on the last IFAC World Congress (2017, Toulouse). The latter were exceptionally successful, and the intention of the present open invited session is to bring together a growing community who are developing and applying such control techniques. Historically, the ILC sessions on ACCs and CDCs have been well attended with at least 35-40 people in attendance on average and a balanced participation from North America, Europe, and Asia. The proposed IFAC invited session promises to have broad appeal as well.