

Open Invited Track Proposal for the IFAC World Congress 2023, Yokohama, Japan
Recent Advances in Iterative Learning and Repetitive Control

Track Code: 8c8sv

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Abstract

Iterative Learning control (ILC) and repetitive control (RC) are high performance tracking control design methods for systems operating in a periodic or repetitive manner. They adapt the control effort based on information collected from previous trials (periods) and thus can lead to significantly better performance than conventional control design approaches even without using accurate system model information. This open invited track aims to bring together results representing the dominant analysis and design paradigms, address new theoretical challenges, and present emerging and non-traditional applications.

Choice of IFAC Technical Committee for Evaluation

TC 1.2. Adaptive and Learning Systems

Detailed Description of the Topic

Iterative Learning control (ILC) and repetitive control (RC) are high performance tracking control design methods for systems operating in a periodic or repetitive manner. To achieve this, they both adapt the control effort based on information collected from previous trials (periods). Compared to conventional control design approaches, ILC and RC potentially lead to significantly better performance even without accurate system model information. Originating from robotic research, ILC and RC have attracted intensive research effort and have proven to be extremely successful in achieving attractive system performance in a wide range of application domains, including manufacturing processes, additive manufacturing, chemical batch processes, next generation health care etc.

After several decades, ILC and RC have progressed considerably in both theoretical research and their practical application with a number of new design/analysis methods and emerging applications reported. This open invited session aims to:

- Bring together results representing the dominant analysis and design paradigms, including frequency-domain design, optimisation based approach, linear repetitive process design, internal model design, design for nonlinear systems
- Address new theoretical challenges in ILC and RC, including robustness, design for flexible tasks, data driven approaches, as well as their connection and comparison to alternative learning-based control approaches, and
- Present new emerging and non-traditional applications.

The open track proposers have in the past successfully organised a series of invited sessions on ILC and RC in major systems and control conferences including American Control Conference, IEEE Conference on Decision and Control, IFAC Workshop on Adaptive and Learning Control Systems. In particular, the proposers organised two open invited tracks and a workshop for the last two IFAC World Congresses (IFAC 2017 Toulouse and IFAC 2020 Berlin). These special sessions have been historically well attended with a good geographical balance and high quality contributions. The proposed open track promises a similarly broad appeal.