

Theory and Applications of Extremum Seeking Control

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This open invited track aims at bringing together mathematicians and engineers working in the field of *extremum seeking control*. The goal of extremum seeking control is to optimize the steady-state performance of a control system using the output measurements. Compared to classical control and optimization problems, extremum seeking problems aim at reducing the amount of information needed for control design. In particular, an optimal operating point as well as analytical expression of the output (cost) function and even the system model may be unknown. Only real-time measurements of the current output value can be accessed. From the mathematical point of view, the lack of information about the system model and analytical expressions of the output and cost functions poses significant difficulties in control design. Meanwhile, a reduced need for detailed information makes extremum seeking control systems highly desirable in real-world applications.

Within the last two decades, the number of results on extremum seeking has increased drastically. In particular, the model-free nature of extremum seeking control has been shown to assist in the development and design of many current research trends in learning, optimization, and data-driven control. Despite significant progress in the theoretical foundations of extremum seeking control, there are still many open questions and perspectives for further developments. The first goal of this track is *to gather the contributions which present novel findings in deterministic and stochastic extremum seeking and address existing challenges, open problems, and further research directions*.

The practical interest to extremum seeking grows continuously because of the development of new technologies. The range of possible applications includes, among others, navigation of mobile agents in unknown environments, maximization of the power output of wind turbines and photovoltaic systems, optimization of processes in chemical and bio-engineering, etc. The second goal of this track

is *to discuss recent advances and challenges in the developments of real-world applications*.

The overall aim of the proposed open invited track is to highlight and re-affirm extremum seeking as an important design alternative in modern control theory. It offers a framework for presenting novel contributions to challenging theoretical problems and recent engineering applications of extremum seeking control, as well as for addressing new trends and perspectives in this area. We expect that the track will result in fruitful discussions between participants from different research centers and thus stimulate future development of analytical methods and design tools in adaptive control.

We invite participants both from mathematical and engineering communities working on the development of extremum seeking controls. We believe that such a track would be of interest to a broad audience at the 21st IFAC World Congress.

The topics include (but are not limited to):

- Stability, robustness and performance of extremum seeking algorithms
- Extremum seeking control and related problems in stabilization and optimization
- Extremum seeking control for hybrid dynamical systems
- Extremum seeking control for infinite dimensional systems
- Stochastic extremum seeking control
- Distributed extremum seeking control and multi-agent systems
- Real-world applications of extremum seeking control algorithms

We expect that the session will result in fruitful discussions between participants from different research centers and provide a platform for exchanging tools, methods, and ideas.