IFAC World Congress 2023, Yokohoma, Japan, July 9-14, 2023

<u>Open Invited Track:
Dynamics, Stability, and Control of Systems with Time Delays;
Theory, Scientific Computation, and Applications</u>

Track Code: 3gi38

IFAC Technical area: TC 2.2 Linear Control Systems

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Synopsis:

This open invited track is proposed on the topic of dynamics, stability, and control of systems affected by time delays, and it is open to contributions including new results in and combinations of theory, scientific computation, and applications.

This track is proposed by the above listed members of the Technical Committee TC 2.2 on Linear Control Systems. Many members of this technical committee for over two decades have been leading efforts in organizing the IFAC Workshop on Time Delay Systems. More precisely, this series started in1998 and in 2022 the workshop will be held in person in Montreal, Canada with around a hundred registered participants. There is also a very active working group on time delay systems whose quarterly webinars are very well attended (typically 100-200 participants). With this open invited track, the goal is to continue the tradition of bringing the scientific community together in the area of systems with time delays. We hope that this invited open track will enable a platform to discuss current research developments and open problems as well as to establish scientific networks.

Time delays appear in a multitude of applications and are often attributed to the root cause of poor performance or instability, if not dealt with properly. An interest in studying dynamical systems and how to control them at the face of time delays has therefore been the attention of engineers, mathematicians, and physicists. Application domains of systems with delays can even be considered larger, expanding into biology, social sciences, economics and artificial intelligence. With many technological advances in network control systems, connected dynamical systems and with the emergence of low cost sensor/actuation/computer systems, the importance of systems with delays is only destined to further grow, as we envision a future with connected, intelligent, autonomous vehicles, networked robotic systems, human-robot interactions, cyber physical systems, and distributed sensor systems.

New technologies come with many advantages for the humankind, but they also bring new problems that challenge the current state of the art. For example, how will we address scalability as we keep building large-scale interconnected systems? How will we develop theory that can scale and help us design such systems and how will we achieve efficient, reliable computation at the face of limitations of hardware? How can we better understand human-machine interactions, including human reaction delays, human decision, and human's ability to perform effective, real time remote control? How can we design controllers that can be a-priori certified to render safe operations? Is it possible to re-design controllers on the fly and rapidly prototype these controllers for systems with delays? And, how can we use delay as a design parameter in order to improve the performance of control systems?

Overall, this open invited track includes but is not limited to the following:

- Modelling and identification
- Design and analysis of large-scale systems
- Filtering and estimation
- Stability and stabilization
- Safety
- Structural and network properties
- Robustness
- Approximation techniques and numerical methods
- Data-driven and machine-learning methods
- Control schemes and application in process control
- Vibration control
- Networked systems
- Multi-agent and autonomous systems
- Smart grid
- Cyber-physical systems
- Connected and automated vehicles
- Intelligent transportation
- Intelligent manufacturing and automation
- Biological systems
- Economics, operations research, and logistics