Proposal for an open invited track on "Time-Delays and PDEs" IFAC World Congress 2017

Organized by

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Abstract

This is a proposal to create an open invited track on "Time-Delays and PDEs" at the 20th IFAC World Congress to be held in Toulouse, France, July 9-14, 2017. In many engineering applications and natural processes involving distributed parameter systems, the underlying mathematical model is described by Partial Differential Equations (PDEs), or time delays, or both. The proposed track will create a discussion forum for the presentation of challenging issues and new results dealing with the coupling between PDEs and time delays. New analysis and design techniques, as well as new interesting application examples are invited for submission to this track.

It is well-known that many engineering systems and natural phenomena are modeled by partial differential equations (PDEs). Control of such infinite dimensional systems received much attention over the last two-three decades. When physical systems (including those modeled by PDEs) are controlled over a network, or some form of a transport is involved between the plant and the controller, time delays appear in the mathematical model in a natural

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way. In this case, new challenges present themselves in the analysis and control of such feedback systems. We propose to form an "open invited track" on this topic of growing interest at the IFAC World Congress 2017 to be held in Toulouse, France.

There are various techniques to compensate adverse effects of time delays on PDE systems, see for example the book by Krstic, [5]. In some cases, time delays may have a stabilizing effect. Some of the mathematical techniques used in the analysis of time delay systems include algebraic methods, operator theory, and Lyapunov techniques, see e.g. recent books [3, 4, 6]. Moreover, operator theoretic approaches to general infinite dimensional system theory, [1, 2] applies to PDEs and time-delays. On the other hand, these techniques need to be tailored towards specific applications at hand, in order to have computationally feasible analysis and design tools.

It is expected that there will be a considerable interest for the proposed track. IFAC Workshop on Time Delay Systems (TDS) has been running successfully in recent years at different geographical locations: Romania (2009), Czech Republic (2010), USA (2012 and 2015), France (2013) and Turkey (to be held in 2016). Moreover, newly established IFAC Workshop on Control of Systems Governed by Partial Differential Equations (CPDE) was first held in 2013 (France) and planned for 2016 (Italy). In addition to these IFAC meetings primarily devoted to the topics to be covered in the proposed track, many successful invited sessions have been organized in major events in recent years such as IFAC World Congress (WC), IEEE Conference on Decision and Control (CDC), European Control Conference (ECC) and International Symposium on Mathematical Theory of Networks and Systems (MTNS). While we expect to receive submissions centering around the main theme of the track, the papers may cover a wide range of application topics of great interest to control researchers from academia and industry that regularly attend major conferences, IFAC WC, CDC, ECC, MTNS.

We also expect that the papers in this track will be of interest to many IFAC Technical Committees, in particular TC2.n; $n = 1, \ldots, 6$ and TC1.5. Hence, we are inviting all papers involving PDEs and time delays, dealing with theory and applications. Theory oriented papers may be in the following topics of interest (not an exhaustive list): stability and stabilization, robustness issues, performance limitations, filtering and estimation, fault tolerant control, output feedback control, numerical methods, sampled-data control, and hybrid systems. Application oriented papers are invited from the fol-

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lowing areas: automotive systems, aerospace, biological systems, chemical processes, energy and nuclear systems, mechanical systems, mechatronics, network controlled systems, power systems, process control, robotics, transportation systems, vibration and control, and other emerging applications.

References

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