

41st IEEE Conference on Decision and Control

Tutorial Workshop Proposal

Fractional Calculus Applications in Automatic Control and Robotics

Topic and purpose of the tutorial workshop

Even though the idea of fractional order operators is as old as the idea of the integer order ones is, it has been in the last decades when the use of fractional order operators and operations has become more and more popular among many research areas. The theoretical and practical interest of these operators is nowadays well established, and its applicability to science and engineering can be considered as emerging new topics. Even if they can be thought of as somehow ideal, they are, in fact, useful tools for both the description of a more complex reality, and the enlargement of the practical applicability of the common integer order operators. Among these fractional order operators and operations, the fractional integro-differential operators (fractional calculus) are specially interesting in automatic control and robotics. The purpose of this full day tutorial workshop is to give an overview of the fundamentals and applications of Fractional Calculus in the aforementioned areas.

Workshop structure

To reach such a goal, the workshop is structured as a mini-course covering both the mathematical foundations of Fractional Calculus (historical introduction, fundamentals of fractional calculus, modelling and dynamic behavior of non-integer order systems), and its most significant and recent practical applications in automatic control and robotics (extended control actions, robust control, vibration isolation, iterative learning and adaptive control, path planning and motion control, system identification, etc.). Each topic will be presented by some of the very experts on the field.

As a complement, some software tools for the analysis and application of the non-integer order operators will be presented during the breaks and at the end of the workshop.

Workshop Schedule

Part I: Fundamentals: I.1. Historical Introduction; I.2. Fractional Calculus Fundamentals; I.3. Fractional Order Systems and Fractional Order Control Actions; I.4. Analog and Digital Implementations of Fractional Order Operators.

Part II: Applications: II.1 Robust Control; II.2 Other Control Applications (Iterative Learning Control, Adaptive Control, Control of Distributed Parameter Systems, etc.); II.3 Robotics; II.4 Systems Identification.

Workshop Organizers

Dr. Blas M. Vinagre Jara (bvinagre@unex.es)
Dept. of Electronics and Electromechanical Engineering
Industrial Engineering School
University of Extremadura
Avda. de Elvas, s/n, 06071 Badajoz, Spain

Dr. YangQuan Chen (yqchen@ieee.org)
Center for Self-Organizing and Intelligent Systems
Dept. of Electrical and Computer Engineering
Utah State University
Logan, UT-84322-4160, USA

List of Potential Contributors

(Order of lectures)

(I.1,I.2) Prof. Igor Podlubny, Dr. Ivo Petras (igor.podlubny, ivo.petras@tuke.sk)
Technical University of Kosice, Kosice, Slovak Republic

(I.3, I.4) Dr. Blas M. Vinagre Jara (bvinagre@unex.es)
University of Extremadura, Badajoz, Spain

(I.4, II.3) Prof. J. A. Tenreiro Machado (jtm@dee.isep.ipp.pt)
ISEP-Institute of Engineering of Porto, Porto, Portugal

(II.1) Prof. A. Oustaloup, Dr. P. Lanusse, Dr. J. Sabatier (oustaloup, lanusse, sabatier@lap.u-bordeaux.fr) University of Bordeaux I, Bordeaux, France

(II.2) Dr. YangQuan Chen (yqchen@ieee.org)
Utah State University, Logan, USA

(II.3) Dr. P. Melchior, B. Orsini (melchior@lap.u-bordeaux.fr)
University of Bordeaux I, Bordeaux, France

(II.4) O. Cois, M. Aoun (cois@lap.u-bordeaux.fr)
University of Bordeaux I, Bordeaux, France