

8th-2022 International Conference on Control, Decision and Information Technologies (CoDIT'22)

May 17-20, 2022
Istanbul, Turkey



Welcome Message



Welcome Message

It is our pleasure to welcome in Istanbul, Turkey, all participants to the 8th International Conference on Control, Decision and Information Technologies (CoDIT'22) being held at the Byotell Hotel, Istanbul on May 17-20, 2022.

Since 2013 the CoDIT conference series has evolved to one of the largest and most important conferences dedicated to Control, Optimization, Decision, Computer Science and Information Technologies. The previous editions of this conference were held respectively in Hammamet - Tunisia in May 2013, Metz - France in November 2014, St. Paul's Bay - Malta on April 6-8, 2016, Barcelona - Spain on April 5-7, 2017, Thessaloniki - Greece on April 10-13, 2018, Paris-France on April 23-26, 2019 and the last previous edition in Prague - Czech Republic on June 29 - July 02, 2020. We consider ourselves fortunate to have the opportunity to organize CoDIT'22 in Istanbul-Turkey.

In addition to the regular papers, CoDIT'22 program includes exciting plenary keynotes and special sessions Papers. We have received around 618 papers from 79 countries worldwide that yielded 285 valid papers. Authors from all continents honored us by reporting their original work. We thank them for submitting their work to our conference.

This year's CoDIT is organized under the technical sponsorship of the IEEE Control Systems Society, the IEEE Systems, Man, and Cybernetics Society, and the International Federation of Automatic Control (IFAC) with the great support of the LISIER Laboratory (University of Tunis), the Department of Mechanical Engineering (Izmir University of Economics), and GDR RO.

Finally, an event of this size and importance cannot be organized without the help of a large number of volunteers. We would like to thank all the members' of the organizing committee for their extraordinary efforts to ensure that this conference will be a successful one.

On behalf of the organizing committee of CoDIT'22

Lale Canan Dülger (*General co-chair*), Izmir University of Economics, Turkey

Maria Pia Fanti (*Program co-chair*), Polytechnic University of Bari, Italy

Achraf J. Telmoudi (*Steering committee chair & Program co-chair*), University of Tunis, Tunisia

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Keynotes

Keynote 1

(May 18, 2022 / 10:25-11:15)

"Traffic Control using Automated Vehicles: Distributed Sensing, Actuation, and Learning"

Prof. Karl H. Johansson (IEEE Fellow)

KTH Royal Institute of Technology, Sweden

Chair: Prof. Lale Canan Dülger, İzmir University of Economics, Turkey

Abstract: While the long-term benefits of introducing connected and automated vehicles into road traffic are widely understood to be revolutionary, there is much debate about whether its early stages will cause an increase in congestion and issues related to human-driven vehicles. Notwithstanding, connected vehicles acting as mobile sensors and actuators could enable traffic predictions and control at a scale never before possible, and thereby a much more efficient use of the available road infrastructure. In this talk, we will present how a new freight transport technology based on automated truck platoons can be the backbone for such a system. Some basic theoretical and experimental results on the control and coordination of truck platoons will be presented. How such platoons influence traffic flows by acting as a moving bottleneck will be discussed together with traffic models suitable for designing novel traffic control systems. It will also be argued that these models are possible to learn automatically from data gathered by platoons acting as traffic flow sensors. Experiments show that relatively few connected vehicles are enough to mitigate stop-and-go waves and improve traffic conditions significantly. The presentation is based on joint work with Miguel Aguiar, Matthieu Barreau, Mladen Cicic, and others.

Biography of Prof. Karl H. Johansson



Karl H. Johansson is Professor with the School of Electrical Engineering and Computer Science at KTH Royal Institute of Technology in Sweden and Director of Digital Futures. He received MSc degree in Electrical Engineering and PhD in Automatic Control from Lund University. He has held visiting positions at UC Berkeley, Caltech, NTU, HKUST Institute of Advanced Studies, and NTNU. His research interests are in networked control systems and cyber-physical systems with applications in transportation, energy, and automation networks; areas in which he has co-authored more than 800 journal and conference papers and holds 6 patents. He is President of the European Control Association and member of the IFAC Council, and has served on the IEEE Control Systems

Society Board of Governors and the Swedish Scientific Council for Natural Sciences and Engineering Sciences. He has received several best paper awards and other distinctions from IEEE, IFAC, and ACM. He has been awarded Swedish Research Council Distinguished Professor, Wallenberg Scholar with the Knut and Alice Wallenberg Foundation, Future Research Leader Award from the Swedish Foundation for Strategic Research, the triennial IFAC Young Author Prize, and IEEE Control Systems Society Distinguished Lecturer. He is Fellow of the IEEE and the Royal Swedish Academy of Engineering Sciences.

Keynote 2

(May 18, 2022 / 16:35-17:25)

"Stability and Consensus of Multi-Agent Systems via Nonlinear Perron-Frobenius Theory"

Prof. Alessandro Giua (IEEE Fellow)

University of Cagliari, Italy

Chair: Maria Pia Fanti, Polytechnic University of Bari, Italy

Abstract: The study of how multiple autonomous agents, composing a Multi-Agent System (MAS), coordinate between them to achieve a desired global behavior has spurred much interest within the control community. A compelling global asymptotic behavior is the consensus, i.e., agreement, among all agents. From a control system perspective, the consensus problem consists in the design of local interaction rules between agents such that their state variables converge to the same value. The case of agents modeled by linear discrete-time dynamical systems has been thoroughly investigated. The evolution of a linear MAS is described by a matrix, which is usually assumed to be nonnegative (all entries are zero or positive) and row-stochastic (all row-sums are equal to one). As a consequence, the theory for consensus in linear MAS has its roots in the theory developed by Perron and Frobenius for nonnegative matrices. In this plenary, I discuss the case of agents modeled by nonlinear discrete-time dynamical systems, whose evolution is described by a nonlinear map. In such a case, the properties of interest for consensus analysis are monotonicity and plus-homogeneity, which can be seen as the nonlinear counterpart of nonnegativity and row-stochasticity. I will show that the evolution of an arbitrary nonlinear discrete-time dynamical systems whose map is type-K monotone and plus-homogeneous eventually converges to an equilibrium point of the system, if any exists. Given a MAS it is possible to give necessary and sufficient conditions on the local interaction rule to guarantee that the map of the overall system satisfies the above-mentioned properties. Finally, I will show that under mild conditions the existence of a globally reachable node in the communication graph is sufficient to converge to consensus. This approach can provide stability results --- and convergence to consensus as a special case --- based on the (distributed) structure of the system rather than on Lyapunov theory.

Biography of Prof. Alessandro Giua



Alessandro Giua is professor of Automatic Control at the Department of Electrical and Electronic Engineering (DIEE) of the University of Cagliari, Italy. He has also held academic and visiting positions in several institutions worldwide, including Xidian University (China) and Aix-Marseille University (France). He received a Ph.D. degree in computer and systems engineering from Rensselaer Polytechnic Institute, Troy, NY, USA in 1992. His research interests include discrete event systems, hybrid systems, networked control systems, Petri nets and failure diagnosis. On these topics he has published extensively, given several talks and managed international and national research projects. He is currently the Editor in Chief of the IFAC journal *Nonlinear Analysis: Hybrid Systems* and a Senior Editor of the *IEEE Trans. on Automatic Control*. He is serving as Vice President for Conference Activities of the IEEE Control Systems Society (2000-21).

He is a *Fellow of the IEE* and a *Fellow of the IFAC* for contributions to discrete event and hybrid systems. He received in 2017 the *People's Republic of China Friendship Award*.

Keynote 3 (Virtual)

(May 19, 2022 / 10:15-11:15)

"Means and measures in control software design to enable Industry 4.0-compliant machines and plants"

Prof. Birgit Vogel-Heuser

Technical University of Munich, Germany

Chair: Prof. Belkacem Ould-Bouamama, Polytech Lille, France

Abstract: The amount of software in machines and plants, including its development effort, is continuously increasing. Consequently, means to design control software compliant to Industry 4.0 and the measures to prove it are of high economic interest. The talk will introduce means to analyze existing legacy control software as a first step to refactoring. Furthermore, beneficial software architectures and selected patterns for the design phase of control software will be presented. Finally, measures for continuously monitoring control code quality will be demonstrated using simple intralogistics up to real industrial application examples.

Biography of Prof. Birgit Vogel-Heuser



Birgit Vogel-Heuser received her Dipl. Ing. degree in electrical engineering in 1987 and her Dr.-Ing. degree in mechanical engineering in 1990 from the RWTH Aachen, Germany. She acquired industrial experience over ten years, including a position as technical director for the Siempelkamp Group. After various professorship positions in Hagen, Wuppertal, and Kassel, she was appointed to the Chair of Automation and Information Systems at TUM in 2009. Prof. Vogel-Heuser is a Senior Member and distinguished lecturer of IEEE and a member of the National Academy of Science and Engineering (acatech). She is also a member of various advisory boards, including the advisory board of the

VDI/VDE-GMA and the board of trustees of the German Museum. Prof. Vogel-Heuser is editor of the handbook Industrie 4.0 and the author of more than 500 scientific publications. The research interests of Prof. Vogel-Heuser are in the area of systems and software engineering as well as in the modeling of distributed and reliable embedded systems. Especially, her research foci are put on the challenges that result from the increasing demand to produce customer-specific products in the plant manufacturing domain. Engineering and education on hybrid process and heterogeneous distributed and intelligent systems using a human-centered approach are also included in her research area.

Keynote 4 (Virtual)

(May 19, 2022 / 16:45-17:35)

"Aerodynamic Flow Control"

Prof. M. Onder Efe

Hacettepe University, Turkey

Chair: Prof. Lale Canan Dülger, İzmir University of Economics, Turkey

Abstract: In this talk, issues in aerodynamic flow control will be discussed. It is well known that aerodynamic flow dynamics are governed by Navier Stokes equations and this coupled and nonlinear equation set displays a rich set of physical phenomena when the operating conditions (like Mach number or flow geometry) change. In this talk, model reduction problems will be described and simple boundary controller designs will be considered for Heat equation, Burgers equation, and an experimental aerodynamic flow control setup will be shown. Solutions and neural network based pointwise modeling results will be discussed for the cavity flow setup.

Biography of Prof. M. Onder Efe



Mehmet Onder Efe has received his Ph.D. degree from EEE Dept. of Bogazici University, Istanbul, Turkey. Having spent a year at Carnegie Mellon University and another at The Ohio State University, he worked at several private universities in Turkey in between 2003-2013. Since 2013, he has been with the Department of Computer Engineering at Hacettepe University.

His research interests include control systems, neural networks and unmanned vehicles.

Dr. Efe is/was and associate editor of IEEE Transactions on Industrial Electronics, IEEE Transactions Industrial Informatics, IEEE/ASME Transactions on Mechatronics, IEEE Transactions on Artificial Intelligence and he currently serves as the Editor-in-Chief for Transactions of the Institute of Measurement and Control.