

Two discussions sessions were held at the end of each day, with the support of *Sli.do*. Among the many outcomes, the discussions pointed out that future advances are needed in theoretical studies of optimization problems and algorithm behaviour (along the lines outlined by *Gabriela Ochoa* in her keynote talk), and in the area of applications the field is moving towards addressing complex challenges (such as those addressed by *Enrique Alba* in his keynote talk).

The *BIOMA 2020 proceedings* were published in the series Lecture Notes on Computer Science (LNCS) by Springer

<https://www.springer.com/gp/book/9783030637095>.

The conference incorporated also a series of social interactions, including many informal chats during coffee and lunch breaks.

The scientific and social programmes of the *BIOMA 2020* conference would not have been possible without the support of the *UTOPIAE* project, the Jožef Stefan Institute of Ljubljana, the Université Libre de Bruxelles, the Von Karman Institute, and the Intelligent Computational Engineering Laboratory (ICELab) of the University of Strathclyde. 🌐

# Latest Research Developments on Dynamic Control and Optimization: Online Discussions at DCO2021 Aveiro, Portugal

**Elóisa Macedo** <macedo@ua.pt>; **Tatiana Tchemisova** <tatiana@ua.pt>;  
**Gerhard-Wilhelm Weber** <gerhard.weber@put.poznan.pl>



▲ *DCO2021*: The Opening Session with Professor Delfim Torres welcoming all participants.

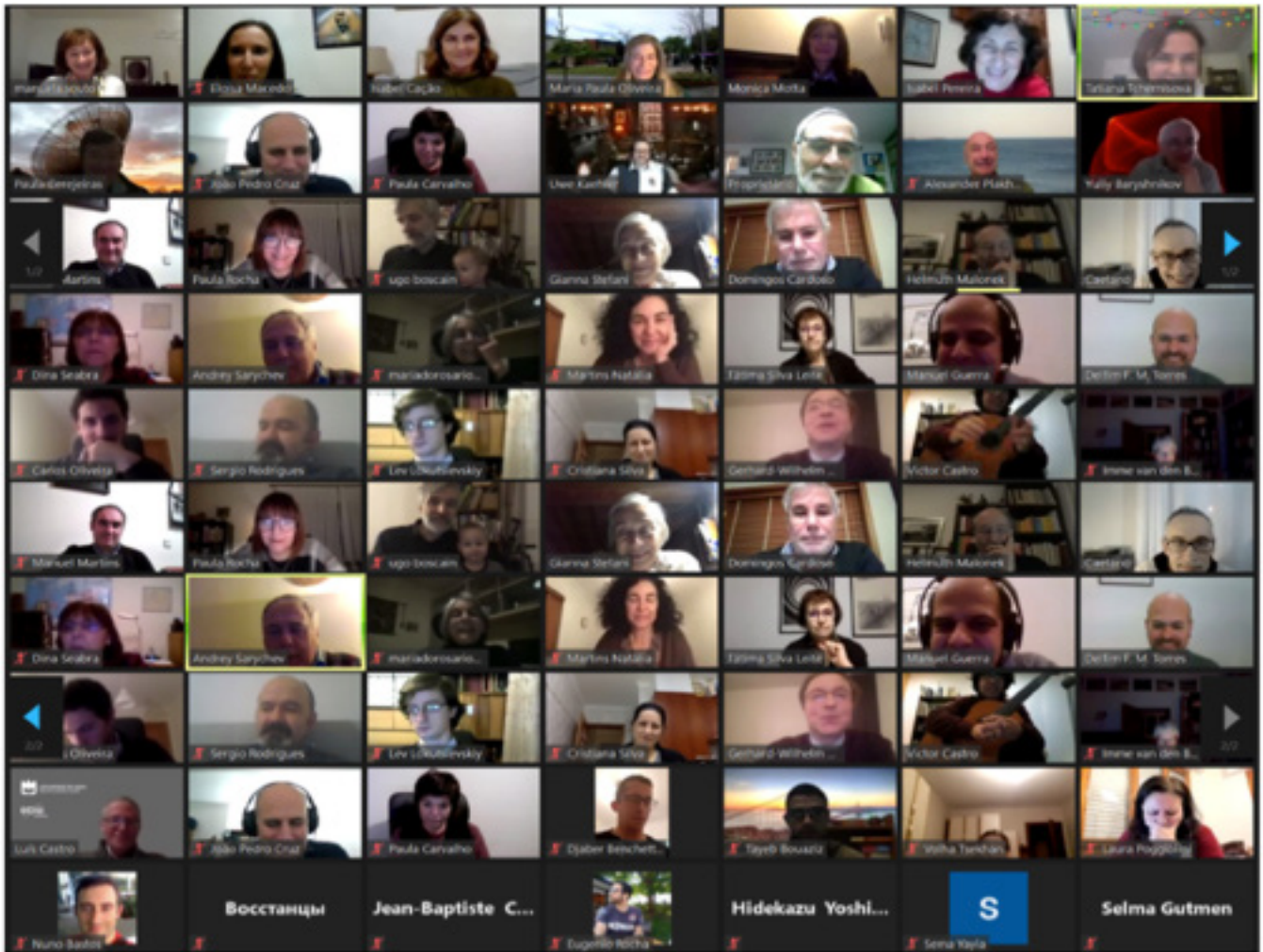
The *Dynamic Control and Optimization International Conference (DCO2021)*; cf. <https://sites.google.com/view/dco2021/dco-2021>) has been held online from 3rd-5th of February, 2021. The DCO2021 has aimed at bringing together academics and providing an environment for learning and exchanging ideas and new developments in diverse areas within the fields of dynamic control and optimization, both on theory and applications.

The conference was organized by the Department of Mathematics of the University of Aveiro (<https://www.ua.pt/pt/dmat>), the Center for Research & Development in Mathematics and Applications (CIDMA, University of Aveiro, cf. <https://cidma.ua.pt/>) and the Center for Applied Mathematics and Economics (CEMAPRE, University of Lisbon; cf. <https://cemapre.iseg.ulisboa.pt/>). The Chairs of the Organizing Committee were: *Professor Delfim F.M. Torres*, *Professor Alexander Plakhov* and *Professor Tatiana Tchemisova* from University of Aveiro. The Conference was organized with the support of *CIM - International Center of Mathematics*, and the *FLAD - Luso-American Foundation*.

The scientific event was organized as part of the celebration of

the 65th birthday of *Professor Andrey V. Sarychev*, recognized expert from the University of Florence, Italy, who taught in the University of Aveiro for various years. *Professor Sarychev* is a Full Professor at the Department of Mathematics and Informatics of the University of Florence and has been actively involved in knowledge extension activities. Since 1995, *Professor Sarychev* is a member of the editorial board of the prestigious *Journal of Dynamical and Control Systems*. The main topics of the International Conference are closely connected with the scientific interests of *Prof. Andrey V. Sarychev*, which include nonlinear dynamical control systems, control of evolution PDEs, optimal control, sub-Riemannian geometry, ordinary differential equations, calculus of variations, and propagation of acoustic waves in elastic media.

Initially planned for a friendly atmosphere on-site attendance, considering the COVID-19 pandemics context, the event was held online and the *DCO2021 Organizing Committee* gathered efforts to prepare a high-quality program divided into three main streams: Dynamic Control, Optimization, and Applications of Control and Optimization. Eleven Invited Talks were given by specialists of relevant scientific recognition from Portugal, USA, Russia, Italy and France. >>



▲ DCO2021: a snapshot of the conference participants.

>> Thirty six contributed talks were organized in eleven parallel sessions focusing on different topics such as Dynamic systems and Geometric Control, Parametric optimal control and time scales, Differential equalities and systems, Optimal control and stabilization, Dynamic Programming and dynamical systems, Stochastic optimal control and differential games, Applications of control and optimization, Convex analysis and optimization, and Risk management, Data assimilation and Profit optimization, and others. The theoretical and practical relations with *Operational Research (OR)* played a very important role in many presentations at DCO2021 which has also become reflected, e.g., by the Special Issue “*Dynamic Control and Optimization*” of the journal *Optimization* (<https://www.tandfonline.com/toc/gopt20/current>) at the occasion of DCO2020. Moreover, the participants became informed about some of main conference highlights of this year’s OR calendar, namely, *EURO 2021* in Athens, Greece (<https://euro2021athens.com>), and *IFORS 2021* in Seoul, Korea (<http://www.ifors2020.kr/>).

The conference opened with Welcome Words by *Professor Delfim Torres*, Director of the CIDMA R&D Unit, who congratulated *Professor Sarychev* for his birthday, followed by *Professor Manuel António Martins*, Director of the Department of Mathematics, and *Professor Luís Castro*, Vice-Rector of the University of Aveiro, who shared with all conference participants that it was a privilege to have worked with *Professor Sarychev* while he was in the University of Aveiro. Then, *Professor Domingos Cardoso* took the floor to explain how important *Professor Sarychev* was for the recognition of

the Mathematics Research and Development Unit in Aveiro.

The scientific program included 11 Plenary Talks, namely: “*Control on the groups of diffeomorphisms*”, by *Professor Andrei Agrachev*, from Scuola Internazionale Superiore di Studi Avanzati, Italy; “*Obstacles to stabilization*”, by *Professor Yuliy Baryshnikov*, from University of Illinois at Urbana-Champaign, USA; “*Ensemble controllability of quantum mechanical systems*”, by *Professor Ugo Boscain*, from École Polytechnique, France; “*Optimal bacterial resource allocation*”, by *Professor Jean-Baptiste Caillaud*, from Université Côte d’Azur, France; “*Dynamics of distributed populations and its optimization*”, by *Professor Alexey Davydov*, from Vladimir State University and Moscow State University, Russia; “*Generalized convolutions, differential operators, and Lévy-like processes*”, by *Professor Manuel Guerra*, from Instituto Superior de Economia e Gestão, Portugal; “*Sub-Riemannian structures on homogeneous manifolds*”, by *Professor Fátima Silva Leite*, from University of Coimbra, Portugal; “*Necessary conditions and numerical methods for optimal control involving sweeping processes*”, by *Professor Maria do Rosário de Pinho*, from University of Porto, Portugal; “*Sufficient optimality conditions in Optimal Control*”, by *Professor Laura Poggiolini*, from University of Florence, Italy; “*Sub-Riemannian structures on Engel and Cartan groups*”, by *Professor Yuri Sachkov*, from Program Systems Institute of RAS, Pereslavl-Zalessky, Russia; and “*Elementary geometry is dead. Long live (experimental) elementary geometry!*”, by *Professor Sergei Tabachnikov*, from Pennsylvania State University, USA.

>>



▲ DCO2021: presentation of the book of messages for Professor Sarychev by Professor Paula Oliveira.

>> These sessions were scheduled by four of them at each of the first two days, and three at the final day of the conference. More than 70 participants from 19 countries of Europe, America and Asia attended the conference, among them 19 MSc. and PhD. students, and Postdocs. The presentations were very interesting covering many different perspectives and applications. Some of them became an opportunity to PhD. candidates receive feedback from experts on their research preliminary results and developments. Even in a virtual environment, the DCO2021 Organizing Committee had managed to organize a social event to all attendees. A special musical environment was created through the inspiring, tender and warm sound flow of the guitar by the hands of Mr. Victor Castro, one of the best classical guitar players in Portugal. Another special occasion was to share with Professor Andrey V. Sarychev a book dedicated to him, with several descriptions of nice memories of friends, colleagues and students that took part of Prof. Sarychev's life. It was such a pleasant moment.

In the Closing Session, the chairs of the DCO2021 highlighted that unfortunately, given the COVID-19 circumstance and despite these awkward times everyone is living, no in-person meeting was possible, but it was possible to provide an excellent scientific meeting that allowed for a broader participation and networking, for chatting or scheduling a time to meet virtually later on. Special words were dedicated to Professor Sarychev and all distinguished speakers. Professor Dina Seabra and Professor Paula Oliveira, on

behalf of many of his PhD. students, prepared a surprise for Professor Sarychev, which included sharing a book of messages from all who work closely to him during his years in Portugal: "a great mathematician and friend" (Professor Fátima Leite).

The Plenary Sessions were recorded and will be made available to the public at the conference website.



▲ DCO2021: musical event with Mr. Victor Castro.

The conference chairs are grateful to the members of the Organizing Committee for their valuable support and they also acknowledge the engagement of all the participants and speakers for creating such an outstanding environment, allowing for and fostering fruitful discussions and interesting new plans. 🌍