

2021 Workshop on Machine Learning & Control

Tuesday 30 November 2021

Lagrange Mathematics and Computation
Research Center

<https://www.lmcrc.fr>

Organizers:

Alain Bensoussan, Mérouane Debbah, and
Samson Lasaulce

► To join on Zoom on November 30

<https://us02web.zoom.us/j/81739012748>

Program (Chair : Samson LASAULCE)

Schedule	Topic	Speaker
13:55 - 14:00	Welcome speech	Alain BENSOUSSAN
14:00 - 14:50	« TBA »	Pierre LOUIS- LIONS
14:50 - 15:40	« Training Deep ResNet with Batch Normalization as a First-order Mean Field Type Problem »	Phillip YAM
15:40- 16:30	« Neural Differential Equations, Control and Machine Learning »	Enrique ZUAZUA
16:30 - 16:40	<i>Coffee Break</i>	
16:40 - 17:30	« On Machine Learning for Mean Field Master Equations »	Mathieu LAURIERE
17:30 - 18:20	« Neural Networks and Mean-Field Dynamics »	Zhenjie REN

Invited speakers' biographies →

Biographies of the invited speakers



Pierre-Louis Lions is a Professor in Mathematics with Université Paris Dauphine and with Collège de France where he holds a chair on partial differential equations and their applications. Professor Lions has been awarded with several very prestigious distinctions such as the Fields Medal in 1994, the IBM Prize, the Thomson Prize, the INRIA Prize, and the French Légion d'Honneur. His research works have had a strong impact on the field of partial differential equations. Since 2006, he has been pioneering with Jean-Michel Lasry and developing mean field game theory



Phillip Yam received his BSc in Actuarial Science with first class honours and MPhil from the University of Hong Kong. Supported by the two scholarships awarded by the Croucher Foundation, he obtained a Master of Advanced Study degree, Part III of the Mathematical Tripos, with Distinction in Mathematics from University of Cambridge and a DPhil in Mathematics from University of Oxford. During his postgraduate studies, he was awarded with the E. M. Burnett Prize in Mathematics from University of Cambridge, and the junior

research fellowship from The Erwin Schrödinger International Institute for Mathematics and Physics of University of Vienna. Phillip is currently the Co-Director of the Interdisciplinary Major Program in Quantitative Finance and Risk Management Science, and a full Professor at the Department of Statistics of CUHK. He got appointed as a research fellow in the Hausdorff Research Institute for Mathematics of University of Bonn and a Visiting Professor in the Department of Statistics of Columbia University in the City of New York. He has about a hundred journal articles in actuarial science and financial mathematics, applied mathematics, engineering, and statistics, and has also been serving in editorial boards of several journals in these fields. Together with Alain Bensoussan and Jens Frehse, he wrote up the first monograph on mean field games and mean field type control theory.



Enrique Zuazua holds a [Chair in Dynamics, Control and Numerics - Alexander von Humboldt Professorship](#) at FAU - Friedrich-Alexander University (Germany). He also leads the research project "[DyCon: Dynamic Control](#)", funded by the **ERC**, [University of Deusto](#) - Bilbao (Spain) and the [Department of Mathematics](#), at UAM - Autonomous University of Madrid where he holds secondary appointments as Director of CCM - [Chair of Computational Mathematics](#)

and Professor of Applied Mathematics (UAM). His fields of expertise in the area of Applied Mathematics cover topics related with Partial Differential Equations, Systems Control and Machine Learning, led to some fruitful collaboration in different industrial sectors such as the optimal shape design in aeronautics and the management of electrical and water distribution networks. His research had a high impact ([h-index=44](#)) and he has mentored a significant number of postdoctoral researchers and coached a wide network of Science managers.

He holds a degree in Mathematics from the University of the Basque Country, and a dual PhD degree from the same university (1987) and the Université Pierre et Marie Curie, Paris (1988). In 1990 he became Professor of Applied Mathematics at the Complutense University of Madrid, to later move to UAM in 2001. He has been awarded the Euskadi (Basque Country) Prize for Science and Technology 2006 and the Spanish National Julio Rey Pastor Prize 2007 in Mathematics and Information and Communication Technology and the Advanced Grants by the European Research Council (ERC) NUMERIWAVES in 2010 and [DyCon](#) in 2016. He is an Honorary member of the of [Academia Europaea](#) and [Jakiunde](#), the Basque Academy of Sciences, Letters and Humanities, Doctor Honoris Causa from the [Université de Lorraine](#) in France and Ambassador of the [Friedrich-Alexandre University](#) in Erlangen-Nuremberg, Germany. He was an invited speaker at ICM2006 in the section on Control and Optimization. From 1999-2002 he was the first Scientific Manager of the Panel for Mathematics within the Spanish National Research Plan and from 2008-2012 he was the Founding Scientific Director of the BCAM - [Basque Center for Applied Mathematics](#). He is also a member of the Scientific Council of a number of international research institutions such as the [CERFACS](#) in Toulouse, France and member of the Editorial Board in some of the leading

Biographies of the invited speakers



**Mathieu
LAURIERE**

Mathieu Laurière is currently a Visiting Faculty Researcher at Google Brain, in the Brain Team (Paris). He obtained his MS from University Paris 6 and ENS Cachan, and his PhD from University Paris 7. Prior to joining Google Brain, he was a Postdoctoral Fellow at the NYU-ECNU Institute of Mathematical Sciences at NYU Shanghai and a Postdoctoral Research Associate at Princeton University, in the Operations Research and Financial Engineering (ORFE) department. His research interests include mean field control and mean field games, numerical methods, partial differential equations, stochastic analysis, machine learning, complexity theory, and quantum computing.



**Zhenjie
REN**

Zhenjie Ren is Maitre de Conférence at CEREMADE in University Paris Dauphine-PSL since 2016. Before doing his PhD in applied mathematics at Ecole Polytechnique, he finished his Bachelier in mathematics and a Master in numerical mathematics at Fudan University, Shanghai. His research so far focuses on the topics closely related to the theories of stochastic process, differential equations and optimal control. More broadly, he is interested in topics related to probability, optimization and game theory, in particular the applications to economics, finance and more recently machine learning.