香 港 大 學
THE UNIVERSITY OF HONG KONG

Institute of Mathematical Research
Department of Mathematics

Frontiers of Mathematics Lecture
Control and Machine Learning

Abstract

Systems control, or cybernetics—a term first coined by Ampère and later popularized by Norbert Wiener—refers to the science of control and communication in animals and machines. The pursuit of this field dates back to antiquity, driven by the desire to create machines that autonomously perform human tasks, thereby enhancing freedom and efficiency.

The objectives of control systems closely parallel those of modern Artificial Intelligence (AI), illustrating both the profound unity within Mathematics and its extraordinary capacity to describe natural phenomena and drive technological innovation.

In this lecture, we will explore the connections between these mathematical disciplines and their broader implications. We will also discuss our recent work addressing two fundamental questions: Why does Machine Learning perform so effectively? And how can data-driven insights be integrated into the classical applied mathematics framework, particularly in the context of Partial Differential Equations (PDE) and numerical methods? This effort is leading us to a new emergening field of PDE+D(ata) in parallel to the development of new Digital Twins technologies.

Biography

Enrique Zuazua (Eibar, Basque Country–Spain, https://dcn.nat.fau.eu/enrique-zuazua/) holds, since September 2019, the Chair for Dynamics, Control, Machine Learning and Numerics - Alexander von Humboldt Professorship, at the Department of Mathematics of the Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU) in Germany and part-time appointments at Universidad Autónoma de Madrid (UAM) and the Fundación Deusto, Bilbao. He is also a member of the Basque Academy "Jakiunde", Fellow of the Artificial Intelligence Industry Academy (AIIA) and of the Academia of Europaea, and scientific advisor of the artificial intelligence company Sherpa AI in Bilbao.

He holds a degree in Mathematics (1984) from the University of the Basque Country, and a dual Ph.D. 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 Universidad Complutense de Madrid, to later move to UAM in 2001.

He has been awarded the Euskadi (Basque Country) Prize for Science and Technology 2006 and the National Julio Rey Pastor Prize 2007 in Mathematics and Information and Communication Technology and the Advanced Grants of the European Research Council (ERC) NUMERIWAVES in 2010, DYCON in 2016 and CoDeFeL in 2022. In 2022 he was awarded the W.T. and Idalia Reid Prize of SIAM. He was invited section speaker in "Control and Optimization" in ICM2006, Madrid.

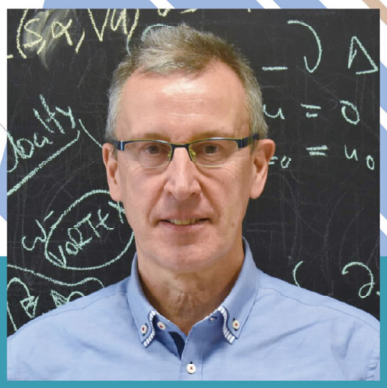
With over 300 articles published, his work had an important impact (h-index = 49). He has supervised 30 PhD students and a broad network of master students, post-doctoral researchers and research and management technicians.

His fields of expertise in the broad area of Applied Mathematics include Partial Differential Equations, Systems Control and Numerical Analysis and Machine Learning.

He is the co-editor-in-chief of the Journals "Mathematical Control and Related Fields" and "Advances in Continuous and Discrete Models" and member of the editorial committee of other Journals and of scientific committees of various centers and agencies.

He was the first Manager for Mathematics of the Spanish National Research Plan in 1999-2002, the Founding Scientific Director of the Basque Center for Applied Mathematics (BCAM) in 2008-2012 and of the Chair of Computational Mathematics at the University of Deusto-Bilbao in 2016, both in Bilbao. Since 2021 he is the inaugural Speaker of the FAU Research Center for Mathematics of Data (MoD).

He also develops an intense dissemination agenda, gathered at https://cmc.deusto.eus/enzuazua/.



Professor Enrique ZUAZUA

Friedrich Alexander Universität Erlangen Nürnberg
- Alexander von Humboldt Professorship, Germany

Date :
26 February, 2025 (Wednesday)

Time :
5:00 – 6:00 pm
(Tea Reception starts at 4:30 pm)

Venue :
Lecture Theatre C, LG1/F
Chow Yei Ching Building
The University of Hong Kong

Sponsored by Glorious Sun Charity Fund

Enquiries:
Tel: 2859 2250
Email: enquiry@maths.hku.hk