



Editorial: Special Issue in Memory of the Late Professor Jian-Xin Xu

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The late Professor Jian-Xin Xu

This special issue is dedicated to the late Professor Jian-Xin Xu, from the Department of Electrical and Computer Engineering, National University of Singapore (NUS). After fighting a serious illness for more than seven years, Professor Xu passed away at the age of 61 on February 7, 2018.

Professor Xu was born in Beijing, P. R. China on October 1, 1958. He received his bachelor's degree in electrical engineering from Zhejiang University, China, in 1982, and then moved to Japan where he completed his master's (1986) and PhD (1989) at the University of Tokyo in the same field. Following that, he worked for Hitachi Research Laboratories for a year, and was then a visiting research fellow at the University of Ohio, USA, and a visiting scholar at Yale University, USA, before joining the NUS faculty in 1991. He was elected a Fellow of the Institute of Electrical and Electronics Engineers (IEEE) in 2012 for his contributions to motion control systems.

Professor Xu is deeply missed by his family, his former students, and his many collaborators and colleagues at the National University of Singapore and around the world, in his beloved field of robotics, learning theory, control theory and applications, and system biology and bio-engineering. During his long career in control engineering, he had published 10 books and monographs, more than 200 refereed journal papers, and more than 300 papers in referred conference proceedings. He had also supervised 67 graduate students and postdoctoral associates.

As his students and co-authors, we all have memories of long hours of discussions in his office, after seminars, in conferences, during flights, — whether early in morning, late in the afternoon, or even late at night. We remember how many times our papers had been thoroughly revised by Professor Xu before they were finally submitted. For us, Professor Xu was always enthusiastic about any new idea and new method in control engineering. He seemed to be very energetic all day, every day, and never got tired or bored. He was a true role model to many of his students.

As a control engineer, Professor Xu always described his life path as a trajectory of a sine wave with many ups and downs. Although the details of this sine wave have not been fully revealed, we can still get the picture of them from



Fig. 1. The late Professor Jian-Xin Xu teaching in Beijing Jiaotong University, August 2007.



Fig. 2. Professor Xu's landscape painting, 27 November 2012.

some highlights obtained from our conversations with him. Professor Xu must have had a very happy childhood as he was able to learn how to play violin when he was young, which was quite unusual at that time, when most Chinese people then were struggling for food.

The first challenge in his life might have come during his teenage years, when he was sent to the countryside during the Cultural Revolution in China. His turning point came when he was lucky enough to pass the National College Entrance Examination and was admitted by Zhejiang University in 1978. His life changed again when he moved from China to Japan to further his studies for postgraduate programs, though he initially struggled with the cultural differences as well as with uncertainties in his career.

He seemed to later on settle down in Singapore with a very successful career at NUS. All these turning points made him extremely persevering. He never gave up even under the worst-case scenario.

His last turning point was when he was diagnosed with Lung Cancer in 2012. Since then, he began to battle lung cancer his way: from adopting a very restrictive diet and living habit, to exploring every possibly promising treatment around the world, to changing his research interests from control engineering to a completely new area: investigating techniques that can improve of cancer treatment, to randomly changing the dosage of his medicines to combat the cancer's developing drug resistance. Obviously, he had used his expertise in control engineering to logically battle cancer, which is almost impossible to do so under such high mental and physical pressure for more than seven years. But he managed. He indeed demonstrated how *a man can be destroyed but not defeated*.

It is impossible to invite all the individuals Professor Xu had impacted to contribute to this special issue because of space and time constraints. This special issue only provides a small sample of the research that Professor Xu inspired. All contributors of the special issue have worked with Professor Xu in a close and extensive way. The six papers



Fig. 3. Photo taken at the NUS 110 Exhibition. Left to right: Saurab Verma, Shenle Tan, Qingyuan Ren, Professor Xu, Jieyang Tan, Yizhen Wang and Xufang Li.



Fig. 4. Photo taken during the American Control Conference, 2001. Left to right: Linchen Xiu, Professor Xu, Ying Tan and Yajun Pan.

cover the subjects of learning control design, analysis and applications, mathematical modelling techniques that can improve cancer treatments, and biomimetic learning in bionic robots.

D. Shen summarizes the recent start-of-art of stochastic iterative learning control (ILC) that will play an important role to deal with randomness of engineering systems. Z. J. Luo, W. J. Xiong, and Y. H. Yu present new ILC algorithms were proposed to achieve consensus tracking for engineering systems with delays. G. Sebastian, Y. Tan, D. Oetomo, and I. Mareels propose new ILC algorithms that can handle both input and output constraints for robotic manipulators. Then, three different ILC algorithms are presented to achieve high precision tracking performance in the presence of highly nonlinearity in piezoelectric actuators by D. Q. Huang and Y. P. Jian. X. F. Li presents the recent development in modelling techniques to build mathematical models that can be used to improve cancer treatments. The last paper, by C. Z. Li, J. Cao, W. J. Ouyang and Q. Y. Ren, presents an exciting area of biomimetic learning in order to generate motion planning and control in bionic robotic systems.

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