A special issue in memory of Nirmal Kumar Bose: multidimensional systems and signal processing

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This special issue of the *Journal of Multidimensional Systems and Signal Processing* is dedicated to the memory of Nirmal Kumar Bose, who passed away on November 22, 2009, in Cologne, Germany.

Born in Calcutta, India on August 19, 1940, Dr. Bose received a B. Tech. degree (Hons.) from the Indian Institutes of Technology, Kharagpur in 1961, an M.S. from Cornell University, Ithaca, NY in 1963, and a Ph.D. from Syracuse University, Syracuse, NY in 1967, all in the field of electrical engineering. He joined University of Pittsburgh in 1967 as a professor of electrical engineering and mathematics. He left Pittsburgh in 1986 to join Pennsylvania State University, where he taught signal processing and founded the university's Center for Spatial and Temporal Signal Processing.

Prof. Bose's sudden passing away was a shock to his family, the university, his past students, friends and collaborators, and the research community in which he had played a vital and leading role for decades. The Bose family organized a memorial ceremony for Prof. Bose on December 6, 2009, at the Pasquerilla Spiritual Center at the Pennsylvania State University. The service was well attended by many, including past and present colleagues and students and friends from the local community.

An obituary for Prof. Bose was published in the June 2010 issue of *Multidimensional Systems and Signal Processing (MSSP)*, written by his former PhD student Sankar Basu. Another obituary, published in the June 2010 issue of the *IEEE Transactions on Circuits and Systems, Part II*, was jointly written by his former Ph.D. student Y. Q. Shi, along with his mentee and collaborator Zhiping Lin. An article entitled "In Memory of Professor Nirmal Kumar Bose," published in *IEICE Fundamentals Review*, vol. 4, no.1, pp. 20–22, 2010, was

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written by his mentee and collaborator Isao Yamada. Basu, Shi, Lin, and Yamada are all board members of *MSSP*.

In addition to the above memorial activities, the Bose family has established the “Dr. Nirmal K. Bose Dissertation Excellence Award” to honor and recognize exceptional research by doctoral students pursuing a degree in Electrical Engineering. The Department of Electrical Engineering of the Pennsylvania State University is also organizing the Bose Memorial Library, composed of the extensive collection of books which were written, referenced, and treasured by Prof. Bose during his academic career. The collection will be housed by the department within the Raspanti Memorial Signal Processing Laboratory.

In addition, we have been recently informed that the main theme of the upcoming International Workshop on Multidimensional Systems (nDS) to be held in September 2011 is “In homage to Professor N. K. Bose.” Prof. Bose was a great supporter of this only workshop in the field of multidimensional systems, and he delivered the opening address on several occasions. At the nDS 2011, his mentee and collaborator Anton Kummert will deliver a special tribute to Prof. Bose’s contributions to the field of multidimensional systems.

Prof. Bose was a pioneer in the development of multidimensional systems theory and multidimensional signal processing. He was one of a few researchers who continuously devoted his time and energy to this field for more than four decades. He guest-edited a special issue of the *Proceedings of the IEEE* in 1977 on “Multidimensional Systems,” edited the book entitled *Multidimensional Systems: Theory and Applications* in 1979, which consists of a collection of the IEEE benchmark papers in the field of multidimensional systems and he authored his first and influential book, *Applied Multidimensional Systems Theory*, published by Van Nostrand Reinhold in 1982.

These works were followed by an edited volume entitled *Multidimensional Systems: Progress, Directions and Open Problems* published by D. Reidel Publishing Company, Dordrecht, Holland in 1985. This book was later revised, expanded and published as *Multidimensional Systems Theory and Applications*, by Kluwer Publishing Company, Dordrecht in 2003, with Bruno Buchberger and J. P. Guiver as co-authors. In 1991, he guest edited a second special issue of the *Proceedings of the IEEE* on “Multidimensional Signal Processing.” He was elected as a Fellow of the IEEE in 1981 for his contributions to multidimensional systems theory and circuits and systems education.

In addition to his pioneering contributions to multidimensional systems and signal processing, Dr. Bose contributed significantly to various related areas such as the restoration and high-resolution reconstruction of blurred and noisy images, the tracking of multiple targets in clutter, combinatorics and graph theory, artificial neural networks, neuro-fuzzy computing, and robust stability theory. These works have been reflected by his many (authored, co-authored or edited) research papers, several dozens of book chapters, and more than 10 books, including the textbook *Digital Filters: Theory and Applications* published by North-Holland Elsevier, NY in 1985, and an expanded version of this book entitled *Digital Filters* by Krieger Publishing Company, Florida in 1993; as well as the book entitled *Neural Network Fundamentals with Graphs, Algorithms and Applications*, co-authored with P. Liang and published by the McGraw-Hill Book Company, NY in 1996.

Sometime around 1990, Prof. Bose foresaw the emerging and substantial interest in the field of multidimensional systems and multidimensional signal processing and founded this journal, for which he served as Editor-in-Chief for over two decades, until his sudden passing away. *MSSP* is the only journal that publishes papers exclusively in this field. He devoted much of his time and effort to maintaining its high quality through the careful selection of an editorial board consisting of outstanding researchers and by organizing relevant and important special issues.

This current special issue, which, as former mentees and collaborators of Prof. Bose, we have been pleased and privileged to edit, covers the field of multidimensional systems and signal processing and topics range from multidimensional circuits and systems theory to diverse multidimensional signal processing applications. It consists of 14 invited papers written by his former students, friends, and collaborators, and by eminent researchers. We regret that we were unable to include more papers.

We would like to take this opportunity to thank all the authors for submitting their excellent work quickly and the reviewers for their outstanding service in reviewing the papers in a timely fashion. We would also like to thank Jennifer Evans, Laura Lander and Miriam Neethi from Springer, as well as Prof. Bose's younger daughter, Enakshi Bose, and Prof. Kenneth Jenkins, Head of Department of Electrical Engineering of the Pennsylvania State University, for their kind assistance in preparing this special issue.