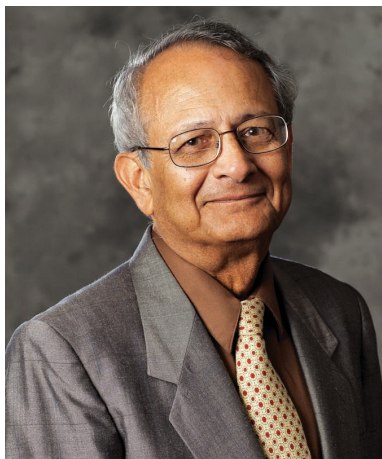


An Interview with Professor Sanjit K. Mitra

In December of 2021, the Associate Editors of the IEEE Circuits and Systems Magazine (IEEE CAS-M), Nele Mentens and Fan Chen had a great chance to interview Professor Sanjit Kumar Mitra. In this interview, Professor Mitra shared with our CAS readers his brilliant career and colorful life, his insights into learning and education, and his inspiring suggestions for young researchers. This interview article sorted out a total of six questions. We hope our CAS readers will enjoy reading this article—Thank You!



Biography

Sanjit K. Mitra is a Professor Emeritus of Electrical & Computer Engineering, University of California, Santa Barbara. Dr. Mitra has served IEEE in various capacities including service as the President of the IEEE Circuits & Systems Society in 1986 and has held visiting appointments in Australia, Austria, Finland, Germany, India, Japan, Norway, Singapore and the United Kingdom. He has received a number of awards from ASEE, IEE (London), IEEE, IEEE Circuits & Systems Society, IEEE Signal Processing Society and European Association for Signal Processing. He is a member of the U.S. National Academy of Engineering, a member of the Norwegian Academy of Technological Sciences, an Academician of the Academy of Finland (appointed by the President of Finland), a foreign member of the Finnish Academy of Sciences and Arts, a foreign member of the Croatian Academy of Sciences and Arts, Croatian Academy of Engineering, and the Academy of Engineering, Mexico, Brazilian Academy of Engineering and a Foreign Fellow of the National Academy of Sciences, India and the Indian National Academy of Engineering. Dr. Mitra is a Life Fellow of the IEEE.

Question 1: You have done tremendous pioneer work in the area of analog and digital signal processing, and image processing such as wavelet-based image fusion and multiresolution image representation. Could you share any issues or obstacles you faced as an academic faculty? Do you have any suggestions for early-career faculty?

Prof. Mitra: At the University of California, Davis, the teaching load of all faculty members was very high as each one was teaching five courses in three quarter long terms. I found it very difficult to have such a high

teaching load with a large number of graduate students who were carrying out their research for their Master's and PhD theses under my supervision. In addition, I was very much interested in teaching courses that were more relevant to our students when most of them join companies as engineers after graduation. To find out what kind of work was being carried out at electronics companies in the Bay Area, I used to visit them on my day off from teaching and discovered that most engineers were involved in the design of both analog and digital electronic circuits using commercial integrated circuits. I mentioned this fact to the chair of the department and at his suggestion I developed a course on analog and digital electronic circuits to replace the required upper division electronic course that was being taught covering semiconductor physics along with the design of analog circuits containing diodes and vacuum tubes. Unfortunately, there were no such books in the market at that time and I ended up writing a book entitled "An Introduction to Digital and Analog Integrated Circuits" (Harper & Row, 1970). I was also involved changing the accompanying laboratory course which consisted of a manual. The students were following the instructions given in the manual and just took measurements they were being asked and did not know how to write a good laboratory report. I developed a laboratory course with each experiment divided into a set of smaller parts and

the students had to answer questions at the end of each part explaining the results that they had obtained before going to the next project. Each report was graded by the teaching assistant and at the end of the term, the student kept the set of all reports. From my brief experience at Bell Laboratories, I found out that writing a good report after completing a project was very important for the staff. As there were not many graduate level courses, I developed and taught graduate level courses on non-linear circuits and computer aided design of circuits, and later developed an upper division course on digital signal processing that I co-taught with another faculty member. I would encourage today's early career faculty to seek out industry partners to help shape the curriculum as well as to help the early career researcher to understand what the important questions are that industry faces. Most of our students will end up in industry, this is a partnership that we should foster.

Question 2: You have received many education awards such as the Education Award of the IEEE Circuits & Systems Society and the Signal Processing Society and the IEEE James H. Mulligan, Jr. Education Medal. You have also cultivated many prominent researchers all over the world. Throughout your career, how do you balance between conducting research and educating? Can you share your approaches to advising students?

Prof. Mitra: I always felt as a faculty member, both research and teaching are equally important. As part of my teaching activities, I believed that it is important to develop new courses for the emerging areas and write textbooks so that future generation of students are able to learn about these areas. I was also very lucky to have excellent doctoral students and I learnt a lot from my interactions with them. In addition, I always had a large number of students and visiting researchers from abroad while being supported by agencies in their countries who basically carried out their Master's thesis and post-doctoral research under my supervision. Having these international researchers in my group also served to teach me about what were the important problems in different countries.

During my post-graduate studies at UC Berkeley, several professors used to give me manuscripts submitted for possible publication and asked me to review them and prepare my comments about them. Many times, the topics were not in my areas of expertise and I went to the libraries to read the papers cited in the references which forced me to learn new topics. Moreover, the professors told me to sign my comments and send them to the editor directly. Afterwards the editor started sending manuscripts directly to me. In addition, I used to read one new paper every day which sometimes trig-

gered new research topics for me to investigate. I always had very few PhD students in my research group which allowed me to work closely with each student.

Question 3: You have achieved numerous successes throughout your career, which were deservedly recognized by your peers through awards, honorary doctoral degrees, honorary professorships, etc. What is the achievement that you are most proud of and why?

Prof. Mitra: I have been very fortunate to have been recognized for my professional contributions to teaching and research by my peers. The first recognition was the receipt of the F.E. Terman Award of ASEE for authoring a text book before I was 40 years old and recognized as an outstanding young engineering educator. The other major awards of which I have very proud of are the Mac Van Valkenburg Society Award of the IEEE Circuits & Systems Society in 1979 for "fundamental contributions to the theory and teaching of active and digital filter theory, and dedicated and creative service to the IEEE Circuits & Systems Society", Society Award of the IEEE Signal Processing Society in 2011 "for important and significant contributions to analog and digital signal processing and image processing", being the first recipient of the Technical Achievement Award of the European Association for Signal Processing (EURASIP), Member of the US National Academy of Engineering in 2003 "for contributions to signal and image processing, for research supervision, and for writing pioneering textbooks", IEEE James H. Mulligan, Jr. Education Medal in 2006 "for outstanding contribution to electrical engineering education through pioneering textbooks, innovative laboratory development and curriculum reform", Athanasios Papoulis Award of EURASIP "for contributions to research and education in signal processing", and the IEEE Gustav Roberts Kirchhoff Award in 2013 "for fundamental contributions to filter design and signal processing".

Question 4: You had several leading positions in the CAS community, such as the Editor-in-Chief of IEEE CAS Magazine and the president of the IEEE CAS Society. How did you experience the transition from being involved mostly in research at the beginning of your career to taking on management roles as your career evolved?

Prof. Mitra: Throughout my professional career, I always have been quite involved with the activities of IEEE, IEEE Circuits & Systems Society, and IEEE Signal Processing Society in various capacities as I believed IEEE being a voluntary organization, it is important of a member to serve the society. Throughout my professional career, I was involved with the activities of IEEE while at the same time continuing my research and

teaching duties. Being involved in professional societies has always introduced me to interesting and active people, many of whom with which I began collaborations later on. Thus, management and leadership roles have eventually had an influence on my research life.

Question 5: You are extremely well connected internationally. We are currently facing the COVID-19 pandemic. How did it influence your international relationships and your work in general? What are the lessons we can learn from the pandemic in the long term?

Prof. Mitra: COVID-19 has definitely affected my international travel. One of the countries I used to visit often was Romania. My first visit to this country was in 2003 when I attended and presented a plenary lecture at the 6th International Symposium on Circuits and Systems. This was my first visit to an East European country which has not had any major contacts with researchers from the western countries. As a result, the faculty and students from Romania and other East European countries were not aware of the current research activities in western countries. I then decided to help the conference organizers by inviting well-known researchers from all

over the world to participate and present invited papers at this series of conferences which gave the local participants an opportunity to interact with these visitors. Unfortunately, COVID-19 prevented me to visit Romania last year when the conference became a virtual event and most speakers including the foreign participants presented their lectures via zoom.

Question 6: If you could go back in time to the start of your career, which advice would you give your younger self? And also, what are your suggestions or advice that you want to give to the younger generation of researchers?

Prof. Mitra: If I went back in time, I would not have changed my trajectory. I worked for a short time at Bell Labs, but I now believe teaching is the best profession I have had. One advantage being a teacher is the freedom to choose the courses to teach and the areas of my research. Accordingly, I have changed my research directions as new research areas emerged. My advice to the younger generations is that they always must be innovative, work on problems that no one has worked before and take chances on new ideas which sometimes may not yield interesting results.



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