

75 Years of Transistor and Its Impact on Humanity **(Birth and Evolution of Semiconductor Devices)**

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Abstract

A birth, though looks accidental soon after the end of second world war was not hailed too much during those days. However, the child grew slowly but steadily with many siblings during the next decades and the associated growth has captured all walks of human activities. The influence is such that even the breathing of present society is so controlled by the stimulus of this birth. A worldwide appraisal during the end of the last century gave the top rank to this baby. It may be noted that the siblings could be born years apart only and that also after marathon efforts. Looking further back, it has precedence with the parents receiving acclaims in certain cases, whereas neglects in some other. In fact, the first semiconductor device development deriving to a patent was 120 years back. We are discussing the births of these fundamental devices which impacted the human life at various stages. Interestingly, the technology progression which happened during these years has immensely helped in developing many useful tools and techniques for the benefit of mankind especially in human life style, health care, entertainment, etc. All these are indebted to the evolution of semiconductor device technology, which is the theme of this talk. Early stages of semiconductor device evolution depicting the key aspects will be discussed in the first part. Further, the progression of technology and its transformation from micro to nano-electronic devices will be discussed in brief. Currently, we stand at another juncture, where the fruits of developments in the last century science and the depth of knowledge mankind acquired through research in material science and various mathematical tools merge to emerge in the form of artificial intelligence, machine learning, quantum technology, etc as new sets of advancements in technological evolution. All these provide a broad picture of the vast field emerged due to device technology development, where the importance still lies in understanding the fundamentals of device physics, materials and interfaces. A very brief overview of these progressions will be presented in this talk along with the evolution to present day applications like Youtube, WhatsApp, etc. The benefits to humanity are immense from all these, but seems to challenge fundamentals of the human thought process and behavioral pattern. A major pattern change is already happening. Reflections from various corners are alarming and a short discussion about such observations is also the part of this talk.

Speaker

Dr. MK Radhakrishnan is the founder of *NanoRel LLP* -Technical Consultants Singapore providing analysis-based solutions to micro/nano electronic industries for improving design and process reliability of devices. As a researcher in the area of semiconductor device physics and analysis for more than 40 years he worked as Director and Principal Consultant to Philips Electronics Singapore/Netherlands (2001-2004), Senior Member Technical Staff at the Institute of Microelectronics Singapore (1993-2001), Device Program Leader in ST Microelectronics (1991-1993) and a Scientist in ISRO (1985-1991). He was Adjunct Professor at National University of Singapore (1994-2007) and Visiting Professor at IISc, Bangalore in 2003-4. He served as a UN Expert for device reliability & analysis under UNDP for ITU, Geneva in 1995-97. Dr. Radhakrishnan is currently the Secretary of IEEE Electron Devices Society (2020 onwards) where he was a Vice-President of the Society (2016-2019) and elected member of the Board of Governors (2011-2016). He is an IEEE EDS Distinguished Lecturer from 1997 onwards. He serves as Editor of IEEE Journal of Electron Devices (IEEE JEDS) and Editorial Board Member of Microelectronics Reliability Journal (UK). He was Editor-in-Chief of IEEE EDS Newsletter (2013-17), Editor of Journal of Semiconductor Technology and Science (JSTS) from 2002-2005 and Guest Editor to IEEE TDMR. As a researcher, academician and technical consultant he works with various MNCs and institutions in Asia, Europe and USA providing consultancy/training on device FA, reliability and ESD. He has given plenary/keynote talks at numerous major international conferences, and has given more than 120 EDS Distinguished Lectures in different countries in all IEEE Regions. He is a Life Fellow of IETE, Life Senior Member of IEEE, Member of EDFAS and ESDA.