

Takeshi Yanagisawa—A Pioneer of Analog Signal Processing

Professor Takeshi Yanagisawa, who passed away in June 2022, was one of the most outstanding leaders in the field of analog signal processing. Professor Yanagisawa graduated from Tokyo Institute of Technology (TokyoTech) in 1953, and received the M.S. and Ph.D. degrees from TokyoTech in 1955 and 1958, respectively. He has greatly contributed to the development of analog circuits, especially RC active filters. Originally, stable analog filters were realized using inductors, capacitors, and resistors. In order to install filters in a monolithic integrated circuit, the inductors must be avoided because of the difficulty of micro miniaturization. This led to the development of analog filter using resistor, capacitors, and active elements such as amplifiers.

Professor Linvill introduced the use of an active two-port called the negative impedance converter (NIC) to realize active RC analog filters [1]. The circuit proposed by Linvill made use of the voltage inversion type of NIC (VNIC) and was suitable to realize transfer functions with poles in the left-half of the complex frequency plane. On the other hand, Professor Yanagisawa proposed RC active filters using a new type of NIC, current inverting NIC (INIC) [2], and showed that both poles and zeros of the transfer function can be selected arbitrarily by using the INIC. This circuit has been named Yanagisawa's circuit which is quite fundamental in the field of RC active networks and has been included in many textbooks of RC active networks [3]. Introducing a balanced type of INIC that can compensate parasitic capacitances and is quite suitable to realize high-frequency RC active filters, he designed a video frequency RC active filter

working at 10 to 100 MHz. Yanagisawa recognized that the gyrator, proposed in 1948 by Bernard D. H. Tellegen as a hypothetical fifth linear element [4] and Professor Yanagisawa invented many active RC circuit structures to realize inductor-less analog filters [5].

Professor Yanagisawa has published more than 10 books; textbooks of analog circuits, technical books in the field of RC active filters, network theory, etc. which have been quite popular for those engaged in the field of analog circuits. He has been a great leader in promoting the level of analog signal processing technology in Japan. IEICE (Institute of Electronics, Information and Communication Engineers of Japan) designated the technologies he developed as one of the Milestones that must be handed down to the next generation.



References

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