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Breast tumor detection using CMOS radar switches

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Radio frequency (RF) single-pole-multiple-throw (SPMT) switch is an important building block in various complementary metal-oxide semiconductor (CMOS) control circuits, such as in radar systems, tumor detection in biomedical applications, phase shifters, multibeam applications, and multiband selection communication systems. Recently, research on microwave radar-based breast tumor detection systems has gained attractions for removing the problems of ionized radiation and painful breast compression of X-ray mammography. In a radar-based microwave tumor detection system, a 3-10.6 GHz ultrawide band (UWB) CMOS-integrated transmitter and receiver are used while controlling antennas by the UWB switching matrix.

In microwave-based breast cancer detection system, a huge double-pole-16-throw (DP16T) mechanical switch is used to control a 16-antenna array. At one time, only one pair of antennas is selected by the switch, where one of the pairs is the transmitting and the other the receiving antenna. If there is any target, the signal reflected from the target or tumor will be received by the receiving antenna, and an image is formed using the confocal algorithm. This conventional mechanical switching matrices, used to control the 16-radar antenna, are large in size, consume huge power of 10 to 100 watts and an obstacle to make a portable compact breast cancer detection system. In this work low power CMOS multi-input-multi-output switches of 1mW have been proposed to replace the conventional mechanical switches in CMOS breast cancer detection device, so that the whole system become compact and portable. The proposed switching matrices are also designed for very large bandwidth from 3 to 20 GHz, for the distortion less communication of UWB Gaussian monocycle pulse.

Speaker Biography

Afreen Azhari has received BSc and MSc in Electrical and Electronics Engineering from Bangladesh University of Engineering and Technology, Dhaka, Bangladesh in 2001 and 2004 respectively. She has a PhD in Integrated Semiconductor Electronics from Hiroshima University, Hiroshima, Japan in 2011. She worked as a researcher in Hiroshima University from 2011–2015 and in the Institute of Scientific and Industrial Research of Osaka University from 2016-2018. Her research interests are Biomedical circuit and system design, CMOS RF integrated circuit and system design.

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