URSI GASS 2023, Sapporo, Japan, 19 – 26 August 2023

Mutual Coupling Reduction Between Closely Packed Microstrip Patch Antennas Using Parallel Coupled-line Resonators

Beytullah BOZKIR [(1)], and Selçuk PAKER [(2)]
(1) ASELSAN Inc, Ankara, Turkey; e-mail: bbozkir@aselsan.com.tr
(2) Istanbul Technical University, Istanbul, Turkey; e-mail: spaker@itu.edu.tr

This paper presents the implementation of a pair of parallel coupled-line resonators (PCLR) for reducing the mutual coupling in electrically close (edge-to-edge spacing 0.07λo) planar 2x1 microstrip patch antenna array.

Mutual coupling reduction in densely packed antenna arrays is an important topic for the antenna researchers. Mutual coupling in an antenna array is caused due to the signal leakage which has a negative impact on the array performance parameters such as scattering parameters, antenna gain, radiation pattern, antenna efficiency etc. The mutual coupling effect increases if the distance between radiating elements is less than λo/2. The mutual coupling caused by the surface wave propagation from one antenna element to another antenna element can be reduced by using various techniques. [1, 2]

In the proposed design, the PCLR is placed between the antenna elements and it is on the same plane of the radiating patches so that the mutual coupling can be suppressed without increasing the profile. The dimensions of the PCLR are chosen as it provides band reject characteristics at the frequency of 1575 MHz which is also the resonance frequency of the antenna. The PCLR decoupling structure cancels the surface wave propagation between the antenna elements and hence increases the isolation. The characteristics of the decoupling structure are analyzed by using the S-parameters to reveal the isolation enhancement characteristics. The simulated and measured results show that a 7 dB isolation enhancement is achieved. Moreover, the PCLR decoupling structure helps to improve the microstrip patch antenna gain 0.96 dB without distorting the pattern of the excited antenna element. The final design is fabricated and the measurement results are in a good agreement with the simulation results.

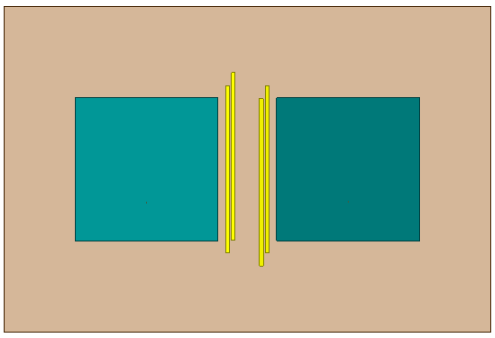

Figure 1. Proposed PCRL decoupling structure between two patch antenna elements.

Keywords: Mutual coupling reduction, line resonators, isolation improvement, surface waves, antenna arrays.

References

[1] M. G. Alsath, M. Kanagasabai, and B. Balasubramanian, "Implementation of slotted meander-line resonators for isolation enhancement in microstrip patch antenna arrays," IEEE Antennas Wireless Propag. Lett., vol. 12, 2013, pp. 15–18, doi: 10.1109/LAWP.2012.2237156.

[2] H. Qi, X. Yin, L. Liu, Y. Rong, and H. Qian, "Improving isolation between closely spaced patch antennas using interdigital lines," IEEE Antennas Wireless Propag. Lett., vol. 15, 2016, pp. 286–289, doi: 10.1109/LAWP.2015.2441739.