

BIBLIOGRAPHY

- [1] L. Xie, X. Cui, S. Zhao, and M. Lu, "Mitigating multipath bias using a dual-polarization antenna: Theoretical performance, algorithm design, and simulation," *Sensors (Switzerland)*, vol. 17, no. 2, Feb. 2017, doi: 10.3390/s17020359.
- [2] E. Basar, "Reconfigurable Intelligent Surfaces for Doppler Effect and Multipath Fading Mitigation," *Frontiers in Communications and Networks*, vol. 2, May 2021, doi: 10.3389/frcmn.2021.672857.
- [3] G. Wu, F. Li, and H. Jiang, "Analysis of Multipath Fading and Doppler Effect with Multiple Reconfigurable Intelligent Surfaces in Mobile Wireless Networks," *Wirel Commun Mob Comput*, vol. 2022, pp. 1–15, Jan. 2022, doi: 10.1155/2022/5751316.
- [4] A. M. Magableh, T. Aldalgamouni, O. Badarneh, S. Mumtaz, and S. Muhaidat, "Performance of Non-Orthogonal Multiple Access (NOMA) Systems Over α -Nakagami-m Multipath Fading Channels for 5G and Beyond," *IEEE Trans Veh Technol*, vol. 71, no. 11, pp. 11615–11623, Nov. 2022, doi: 10.1109/TVT.2022.3189589.
- [5] M. U. Sheikh and J. Lempiainen, "Analysis of multipath propagation for 5G system at higher frequencies in microcellular environment," in *2017 13th International Wireless Communications and Mobile Computing Conference (IWCMC)*, IEEE, Jun. 2017, pp. 1660–1664. doi: 10.1109/IWCMC.2017.7986533.
- [6] K. A. A. Rashid *et al.*, "Design of Linear Polarization Antenna for Wireless MIMO Application," vol. 9, Asian Research Publishing Network (ARPN), 2014, pp. 73–84. doi: 10.1007/978-3-319-07674-4_8.
- [7] H. Saeidi-Manesh and G. Zhang, "Challenges and Limitations of the Cross-Polarization Suppression in Dual-Polarization Antenna Arrays Using Identical Subarrays," *IEEE Trans Antennas Propag*, vol. 68, no. 4, pp. 2853–2866, Apr. 2020, doi: 10.1109/TAP.2019.2955158.
- [8] K. Dave *et al.*, "Graphene-based double-loaded complementary split ring resonator (CSRR) slotted MIMO patch antenna for spectroscopy and imaging THz applications," *Appl Phys A Mater Sci Process*, vol. 128, no. 8, Aug. 2022, doi: 10.1007/s00339-022-05820-6.
- [9] M. Alsharari, S. Lavadiya, K. Aliqab, A. Armghan, M. G. Daher, and S. K. Patel, "A Novel Design of Complementary Split Ring Resonator Metamaterial-Based Low-Profile MIMO Antenna with Defected Ground Structure for S/C/X/Ka Band Applications," *Micromachines (Basel)*, vol. 14, no. 6, Jun. 2023, doi: 10.3390/mi14061232.
- [10] D. Ziani, M. Belkheir, M. Rouissat, and A. Mokaddem, "Design optimization for microstrip antennas based on polymethyl methacrylate

- (PMMA) substrate and carbon nanotube (CNT) conductive material in sub-6 GHz band,” *Beni Suef Univ J Basic Appl Sci*, vol. 13, no. 1, Dec. 2024, doi: 10.1186/s43088-024-00486-w.
- [11] Padmavati and Y. S. Lalitha, “Study of Circular Complementary Split Ring Resonator on a Heterogeneous Substrate Material,” *Wirel Pers Commun*, vol. 113, no. 4, pp. 1973–1983, Aug. 2020, doi: 10.1007/s11277-020-07303-4.
 - [12] Y. Natali, R. Irvana, Y. Yudiansyah, D. Widi Astuti, D. Astuti C, and C. Apriono, “Study on Defected Ground Structure Models with Miniaturized Patches for Broadband Wireless Systems,” *Journal of Communications*, vol. 19, pp. 168–174, Mar. 2024, doi: 10.12720/jcm.19.3.168-174.
 - [13] S. Kumar and A. S. Dixit, “A Miniaturized CSRR Loaded 2-Element MIMO Antenna for LTE Band,” *Mathematical Modelling of Engineering Problems*, vol. 8, no. 6, pp. 984–988, Dec. 2021, doi: 10.18280/mmep.080620.
 - [14] Y. Rahayu and S. MZ, “Investigasi Perancangan Simulasi Antena MIMO 64 Elemen untuk Aplikasi 5G,” *Jurnal Telekomunikasi dan Komputer*, vol. 11, no. 2, p. 143, Aug. 2021, doi: 10.22441/incomtech.v11i2.10903.
 - [15] R. H. Elabd, A. J. A. Al-Gburi, and A. A. Megahed, “Compact circular MIMO antenna with defected ground structure (DGS) for improved isolation in 5G sub-6GHz mobile systems,” *Results in Engineering*, vol. 27, p. 105737, Sep. 2025, doi: 10.1016/j.rineng.2025.105737.
 - [16] A. Baz, D. Jansari, S. P. Lavadiya, and S. K. Patel, “Miniaturized and high gain circularly slotted 4×4 MIMO antenna with diversity performance analysis for 5G/Wi-Fi/WLAN wireless communication applications,” *Results in Engineering*, vol. 20, Dec. 2023, doi: 10.1016/j.rineng.2023.101505.
 - [17] M. Aminu-Baba *et al.*, “A compact triband miniaturized MIMO antenna for WLAN applications,” *AEU - International Journal of Electronics and Communications*, vol. 136, Jul. 2021, doi: 10.1016/j.aeue.2021.153767.
 - [18] T. Liu *et al.*, “Compact U6G Massive MIMO Antenna Arrays With Double-Layer Partial Reflective Decoupling Layers for Mutual Coupling Suppression,” *IEEE Open Journal of Antennas and Propagation*, vol. 4, pp. 764–778, 2023, doi: 10.1109/OJAP.2023.3296623.
 - [19] K. R. Jha, N. Rana, and S. K. Sharma, “Design of Compact Antenna Array for MIMO Implementation Using Characteristic Mode Analysis for 5G NR and Wi-Fi 6 Applications,” *IEEE Open Journal of Antennas and Propagation*, vol. 4, pp. 262–277, 2023, doi: 10.1109/OJAP.2023.3249839.
 - [20] Y. Nur Rahmawati and H. Ludyati, “The Characteristic of a 3.5 GHz Circular Patch Antenna Using Open-Ring Artificial Dielectric,” Atlantis Press International B.V., Nov. 2021, p. 387. doi: 10.2991/aer.k.211106.062.

- [21] A. M. Damanik, E. Kusumawardhani, and F. Imansyah, "Design of 2x2 MIMO Microstrip Antenna With 4 Circular Patch Array Elements for Wifi Technology at 2.4 GHz Operating Frequency," *Journal of Electrical Engineering, Energy, and Information Technology (J3EIT)*, vol. 12, no. 1, p. 249, Apr. 2024, doi: 10.26418/j3eit.v12i1.75742.
- [22] S. Bisoyi, P. Muralimohan, H. K. Dureppagari, P. R. Manne, S. Amuru, and K. Kuchi, "Massive MIMO With Circular Antenna Array: Design, Implementation, and Validation," *IEEE Access*, vol. 12, pp. 21070–21083, 2024, doi: 10.1109/ACCESS.2024.3362245.
- [23] D. Kumutha, T. Islam, P. Muthumari, K. Vijayalakshmi, R. Rajalakshmi, and M. Indumathi, "Design and Analysis of Two Element Modified Circular Shaped MIMO Antenna for 5G Application," *Journal of Nano- and Electronic Physics*, vol. 16, no. 3, pp. 03010-1-03010–5, 2024, doi: 10.21272/jnep.16(3).03010.
- [24] R. Thommandru and R. Saravanakumar, "Cost-effective circularly polarized MIMO antenna for Wi-Fi applications," *Indonesian Journal of Electrical Engineering and Computer Science*, vol. 36, no. 2, p. 785, Nov. 2024, doi: 10.11591/ijeecs.v36.i2.pp785-792.
- [25] T. G. Abouelnaga, I. Zewail, and M. Shokair, "16-ports indoor base station MIMO array for sub-6 GHz 5G applications," *Telecommun Syst*, vol. 80, no. 4, pp. 589–597, Aug. 2022, doi: 10.1007/s11235-022-00916-z.
- [26] A. Gupta and R. K. Jha, "A Survey of 5G Network: Architecture and Emerging Technologies," 2015, *Institute of Electrical and Electronics Engineers Inc.* doi: 10.1109/ACCESS.2015.2461602.
- [27] J. G. Andrews *et al.*, "What Will 5G Be?," *IEEE Journal on Selected Areas in Communications*, vol. 32, no. 6, pp. 1065–1082, May 2014, doi: <https://doi.org/10.1109/JSAC.2014.2328098>.
- [28] V. SINGH Jadaun, P. Kumar, A. Singh Kirar, V. Singh Jadaun, and P. Kumar Sharma, "Design a Circular Microstrip Patch Antenna for Dual Band," 2013. [Online]. Available: www.ijecct.org
- [29] C. Abdelhamid and H. Sakli, "Mutual Reduction in the Coupling of the MIMO Antenna Network Applied to the Broadband Transmission," *Advances in Science, Technology and Engineering Systems Journal*, vol. 5, no. 2, pp. 338–343, 2020, doi: 10.25046/aj050244.