

# Reconfigurable Microstrip Yagi-Uda Antenna with Steerable Circularly Polarized Beam

*Ahmed Khidre, Fan Yang, and Atef Z. Elsherbeni*

**Abstract:** The recent demand of compact wireless devices propels the development of pattern reconfigurable antennas. They can steer their beam direction that helps in avoiding noisy environment, and strengthening the signal detection from an intended target. Classically, beam steering is realized with phased arrays, but it might be too large or complex to meet the demand of compactness or cost reduction. This paper proposes a novel reconfigurable microstrip antenna with circularly polarized beam scanning feature. It is based on a microstrip Yagi-Uda antenna of two square patches. One patch is driven with two orthogonal feeds and the other is parasitic. The parasitic patch is loaded with four lumped varactors and a DC biasing network, to effectively change its electrical size. Because the main beam direction is determined by the electrical size of the parasitic patch, electronic beam scanning is allowed by changing the capacitance value through the applied DC voltage. Operating at 2.45 GHz, the antenna shows a beam scanning range from  $-36^\circ$  to  $32^\circ$  with 2.3 dB gain variation across the entire scanning range and gain peak value of 8.1dBi.

**Keywords:** Reconfigurable antennas, beam scanning antennas, Yagi-Uda microstrip antenna, circular polarization.

## References:

- [1] S. Zhang, G. Huff, J. Feng, and J. Bernhard, "A Pattern Reconfigurable Microstrip Parasitic Array," *IEEE Trans. Ant. propag.*, vol. 52, no. 10, pp. 2773-2776, October, 2004.
- [2] X. Yang, B. Wang, W. Wu, and S. Xiao, "Yagi Patch Antenna With Dual-Band and Pattern Reconfigurable Characteristics," *IEEE Ant. Wireless propag. Lett.*, vol. 6, pp. 168-171, 2007.
- [3] R. L. Li, V. F. Fusco, and R. Cahill, "Pattern shaping using a reactively loaded wire loop antenna," *IEE Proc. Microw., Antennas Propag.*, vol. 148, pp. 03-208, Jun. 2008.
- [4] J. Huang and A. C. Densmore, "Microstrip Yagi array antenna for mobile satellite vehicle application," *IEEE Trans. Ant. Propag.*, vol. 39, no. 7, pp. 1024-1030, 1991.

## Authors:

*Ahmed Khidre* - Received his B.Sc. from Ain Shams University. Currently, he is working towards his PhD degree in electrical engineering, at The University of Mississippi. His research interests include reconfigurable antennas analysis and measurements, beam scanning antennas, and FDTD for EM modeling and simulation.

*Fan Yang* - is an Associate Professor at the Electrical Engineering Department, The University of Mississippi. His research interests include antenna theory, designs, and measurements, electromagnetic band gap (EBG) structures and their applications, computational electromagnetics and optimization techniques, and applied electromagnetic systems such as the radio frequency identification (RFID) system and advanced solar energy system.

*Atef Z. Elsherbeni* - is a Professor of Electrical Engineering and Associate Dean of Engineering for Research and Graduate Programs at The University of Mississippi. Dr. Elsherbeni is a Fellow member of the Institute of Electrical and Electronics Engineers (IEEE) and a Fellow member of The Applied Computational Electromagnetic Society (ACES). He is the Editor-in-Chief for ACES Journal.

---

Department of Electrical Engineering, The University of Mississippi, MS, 38677, akhidre@olemiss.edu, fyang@olemiss.edu, atef@olemiss.edu .