Phased-Locked Loop Coupled Array for Phased Array Applications

Tech ID: 32289 / UC Case 2021-635-0

ABSTRACT

Researchers at the University of California, Davis have developed a phased-locked loop coupled array system capable of generating phase shifts in phased array antenna systems - while minimizing signal losses.

FULL DESCRIPTION

Phased array antenna systems have a wide range of applications, including radar, sonar, long distance communications and imaging. An array contains evenly spaced antennas, often deployed in a two-dimensional grid pattern. Each antenna can be independently controlled - using phase shifters - to steer electromagnetic waves in a particular direction and thus create a concentrated beam. This approach allows the frequencies of the waves emitted by adjacent antennas to be adjusted as needed. These waves then superimpose to create the desired signal. However, current phase shifter technologies have limitations – including increased power consumption, risk of signal loss and limited operating ranges - especially when deployed in high frequency applications. Often, additional, complex, components are also required to design a phase shifter that can handle high frequencies.

Researchers at the University of California, Davis have developed a new architecture for generating phase shifts in phased array antenna systems. Phased-locked loop (PLL) coupled arrays generate phase shifts at high frequencies, while also being power efficient and scalable. This technology deploys a two-element, PLL-coupled, array that can be used in millimeter-wave and sub-terahertz phased array applications. The device regulates the voltage-controlled oscillators (VCOs), while simultaneously maintaining a steady reference frequency.

This PLL-coupled array architecture eliminates the need for phase shifters at high frequencies. In addition, eliminating the requirement for long signal routings at high frequencies makes this technology scalable for mm-wave and sub-THz phased arrays that contain a large number of elements. This new, PLL-coupled, array architecture results in decreased signal losses, even after increasing power consumption.This technology’s simplified design also eliminates the requirement to route phases to multiple endpoints.

APPLICATIONS

- Multiple civilian and military applications
- Long distance communication transceivers
- Applications requiring high frequency transmissions

FEATURES/BENEFITS

- More power efficient than current technologies
- Can be scaled to fit larger designs with minimal adjustments
- Eliminate the need for phased array systems to incorporate additional, complex, and high-cost components

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Published Application	20230163461	05/25/2023	2021-635
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OTHER INFORMATION

KEYWORDS

Phase array, Antenna, High frequency signal transmission, Phase-locked loop, PLL, Voltage-controlled oscillators (VCOs)

CATEGORIZED AS

- **Communications**
  - Internet
  - Networking
  - Wireless
- **Computer**
  - Hardware
- **Imaging**
  - Remote Sensing
- **Security and Defense**
  - Screening/Imaging
- **Engineering**
  - Other

RELATED CASES

2021-635-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Reversed Feedback Amplifier Architecture
- Ultra-High Range Resolution Doppler Radar Front End With Quadrature-Less Coherent Demodulation
- Field Effect Bipolar Transistor
- Low Energy and Noise Sub-Sampling Phase-Locked Loop
- Signal Statistics Compression-Based Quantization Method in an ADC
- High-Frequency Imaging and Data Transmission Using a Re-configurable Array Source with Directive Beam Steering
- Hybrid Electromechanical Metamaterials for Optical and Electrical Devices
- Scalable Phased Array Standing Wave Architecture
- Embedded Power Amplifier
- Reducing Electrical Current Variations in Phase-Locked Loop Systems

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