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Method for Phase Control in Distributed Arrays

A method of phase alignment in large antenna arrays to improve scalability with low power consumption

IP Status: US Patent Pending; Application Number US18/446,986

Applications

- 5G mm-wave Communications
- Sub-Terahertz (6G) Communications
- Radar

Key Benefits & Differentiators

- **Scalable:** Distributing the phase alignment prevents a scale up in cost as arrays grow as compared to traditional, centralized approaches
- **Decreased calibration time and power consumption:** Eliminating the need for central control makes phase alignment dependent on interaction with only the nearest neighbor

Technology Overview

In radar and communications systems there are a number of advantages to moving to systems with more and more antennas. One such advantage is that you can adjust the signal for each antenna in order for the signal to add constructively and destructively such that you can steer the signal in certain spatial locations while minimizing it in others. This concept applies to both transmitted signals and received signals. Traditional approaches rely on a central, global optimization approach to adjust the individual antennas. However, when the number of antennas significantly increases (into the hundreds) for large-scale radar systems or 5G/6G sub-Terahertz wireless communications, the calibration overhead is large from a computational perspective as well as from a power perspective. This limits adoption of large scale phased arrays because of the high cost and low efficiency.

Researchers at the University of Minnesota have developed a method to calibrate large scale phased arrays by syncing the antennas locally to the adjacent element. This method provides background phase tuning and self-alignment between adjacent sources via a nearest-neighbor interferometric approach. By eliminating the need for interaction with a central control, antennas are adjusted faster and with lower power requirements. Additionally, this approach can be applied to both transmitters and receivers. Increasing the scalability of large scale phased arrays at decreased cost can enable the adoption of the technology in both military radar and communications (5G and 6G).

Phase of Development

TRL: 2-3
Prototype chip with 7-element phased array

Desired Partnerships

Technology ID
2022-316

Category
All Technologies
Engineering & Physical Sciences/Instrumentation, Sensors & Controls
Software & IT/Communications & Networking

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Researchers

- **Yahya Tousi, PhD** Assistant Professor, Department of Electrical and Computer Engineering

References

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