Self-Steering Transceiver with Autonomous Beam-Forming (#7360)

An all-passive, self-steering RF front-end beam-forming transceiver array with zero direct power consumption

Georgia Tech inventors have developed a wideband wireless transceiver architecture which can operate on phased-array or multiple input, multiple output systems. It can achieve autonomous beam-forming and beam-alignment towards the desired signal, perform automatic dynamic tracking and rejection of unknown interference signals, and can be fully scalable to a large sized array system and reject arbitrary number of interference signals. This first ever all passive approach serves as an automatic and large-range beam-forming block at the RF front-end. Unlike any existing active self-steering beam-forming blocks, the all-passive nature of the proposed design ensures its zero DC operation power, which is critical for large-scaled and energy-constraint phased-arrays.

Benefits/Advantages

- **Simple operation** – operates on phased-array and MIMO systems with zero power consumption
- **Autonomous operation** – achieves autonomous beam-forming and beam-alignment towards desired signal
- **High sensitivity** – performs automatic dynamic tracking and rejection of unknown interference signals
- **Simple design** – ultra-compact with low circuit complexity
- **Fully scalable** – can operate effectively with a large sized array system
- **Robust** – operates in either fully analog or mixed-signal modes

Potential Commercial Applications

- Wireless communication systems
    - 5G communicationBase-station and cell-tower communication
- Military applications
    - High performance radars
    - Field-deployable sensors
- Energy harvesting systems

Background/Context for This Invention

Accurate, agile, and autonomous beamforming at the RF (radio frequency) front-end is essential for high-performance phased-arrays (computer-controlled array of antennas). Many attempts to align array beams

can cause substantial delay in system response time and needs manual alignments. While some promising technologies, such as coupled oscillator arrays and coupled phased-locked loops, can realize self-steering beam-forming without external signals or manual tuning, they can consume a considerable amount of direct current power.

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More Information

Publications

A 23-to-30GHz Hybrid Beamforming MIMO Receiver Array with Closed-Loop Multistage Front-End Beamformers for Full-FoV Dynamic and Autonomous Unknown Signal Tracking and Blocker Rejection

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A Full-FoV Autonomous Hybrid Beamformer Array With Unknown Blockers Rejection and Signals Tracking for Low-Latency 5G mm-Wave Links (IEEE Transactions on Microwave Theory and Techniques)

A 5GHz All-Passive Negative Feedback Network for RF Front-End Self-Steering Beam-Forming with Zero DC Power Consumption (Radio Frequency Integrated Circuits Symposium)

An All-Passive Negative Feedback Network for Broadband and Wide Field-of-View Self-Steering Beam-Forming With Zero DC Power Consumption (Journal of Solid-State Circuits)

2018 IEEE Microwave Theory and Techniques Society (MTT-S) Graduate Fellowship (This award is the highest student honor from the IEEE Microwave Theory and Techniques Society.)

For more information about this technology, please visit:
https://licensing.research.gatech.edu/technology/self-steering-transceiver-autonomous-beam-forming

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