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Reconfigurable Antenna Array with Multi-Feed Antenna Pixels

A technology that consists of a fully, re-configurable pixelated antenna array that reduces or eliminates loss and distortion challenges that conventional switch-based tunable antennas suffer

Hua Wang, Jongseok Park, and Taiyun Chi From the School of Electrical and Computer Engineering at Georgia Tech created a technology that consists of a fully, re-configurable pixelated antenna array that reduces or eliminates loss and distortion challenges that conventional switch-based tunable antennas suffer. It employs and extends the multi-feel antenna concept by implementing each pixel as an array of electrically small radiators connected with distributed feeds. This design, a switchless reconfigurable antenna array with distributed and co-adaptive multi-feed antenna pixels or "RAMP", enables individual configurability of both amplitude and phase at each antenna pixel. It consists of actively modulating the currents at the multi-feeds of the antenna to synthesize the RF current distribution and achieve the desired reconfigurable radiation characteristics. Programmable near-field coupling helps extend the tuning flexibility of the antenna. By eliminating the need for switches or tunable components and enabling reconfiguration of the pixel-level radiation characteristics, the RAMP provides array-level arbitrary polarization, operating frequency tunability, power level and linearity enhancement. These enhancements in the antenna construction results in high-efficiency power combining at the antenna-level and enhanced power handling capacity of the antenna system as a whole.

Summary Bullets

- Enables direct and intuitive programming of RF current distribution, simplifying the setting and prediction of the resulting antenna array pattern
- Allows broad bandwidth operation, i.e. S-band to X-band operation (2-12 GHz)
- Easy deployment is made possible by not mandating computationally intensive optimization

Solution Advantages

- Enables direct and intuitive programming of RF current distribution, simplifying the setting and prediction of the resulting antenna array pattern
- Allows broad bandwidth operation, i.e. S-band to X-band operation (2-12 GHz)
- Easy deployment is made possible by not mandating computationally intensive optimization
- Provides active near-field power combining to increase the power-level and reduce the linearity stress on pixel-level

Potential Commercial Applications

The primary use for this technology is in military and commercial systems that use reconfigurable antenna array technology. Applications that would benefit from the advantages delivered by this invention include multi-mode, multi-band wireless communications and radar/imaging systems, wireless communication with enhanced security, highly efficient near field communication, astronomy systems, electronic warfare, and SIGINT (Signals intelligence) platforms.

Background and More Information

Antennas are a critical part of all wireless communication systems. Reconfigurable antennas are capable of dynamically modifying their frequency and radiation properties in a controlled and reversible manner. They are constructed with an inner mechanism (such as RF switches, varactors, mechanical actuators or tunable materials) to redistribute the RF currents over the antenna surface and produce reversible modifications over its properties. The reconfiguration capability is used to maximize antenna performance when environmental conditions are changing or to satisfy different operating requirements. This invention extends reconfigurability to allow for customized radiation characteristics at different levels within the antenna's array and pixel elements.

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