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Potential Unique Chance towards Wireless Communication Technology

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Editorial

The wireless industry is looking toward Beyond-5G (B5G), or 6G, technological advancements as the world observes increasing deployments of the Fifth Generation (5G) network, in anticipation of the proliferation of new applications and use cases that demand wireless communication- and sensing networks with significantly higher agility, coverage, and throughput. Autonomous driving, tactile remote interface, and augmented reality are examples of emerging B5G uses. Similar to how massive Multi-Input-Multi-Output (MIMO) emerged as an exciting research topic a decade ago, becoming a crucial enabler for the evolution of commercial deployment from 4G to 5G, new technological enablers capable of delivering a tenfold performance gain over their 5G counterparts will be required for such applications. An RIS's passive and conformal characteristics make it simple to integrate onto already-existing surfaces while non-intrusively enhancing the environment of current wireless networks to improve spectral efficiency and energy efficiency without changing the wireless standards and designs for transceivers already in use. RISs have been found to facilitate sensing, localization, and wireless power transmission in addition to improving the functionality of wireless communications networks. It may be especially helpful for networks using high-frequency bands, where channel rank deficiency and blockage- and absorption-induced dead zones are common performance bottlenecks that would otherwise require the deployment of extremely dense Base Stations (BS), which would increase power consumption and backhaul costs [1,2].

It is clear that the advancements gained thus far have mostly been made through study and simulation, frequently on systems with perfect assumptions while also ignoring the protocol and compute overhead connected with the implementation of real-world networks. Furthermore, because the propagation environment has a much larger physical footprint than the communications endpoints, multiple distributed passive surfaces over a much larger environment are now required to achieve power concentration on receivers, which was previously accomplished by co-located coherent endpoint beam forming. Unit-area costs and power consumption must be sufficiently low for the total cost of ownership to be comparable to those of a traditional co-located or dispersed MIMO in order to justify a commercially feasible deployment. Fundamentally, Snell's law governs the connection between the angle of incidence and the angles of reflection and refraction when a wireless signal, or often an EM wave, hits the boundary between two isotropic media. The angle of incidence and the angle of reflection are the same for uniform surfaces of a medium, especially for reflection. Recent developments in the study of reflectarrays with metasurfaces have made it possible to alter the surface's impedance and produce a specific phase shift between incident and scattered waves. The EM wave is tuned to a different angle instead of the symmetric reflecting wave when the surface is fragmented into a large number of closely spaced components and each metasurface element is configured to have proper phase shifts [3,4].

While the IRS is the subject of most research interests in RISs, as already said, there is still need for more investigation into other RIS features. The fundamental capabilities of RIS may be summed up as follows if conditions are restricted to either the input or output signal being a plane wave. 1) reflection/refraction, where a plane wave's original direction of propagation is changed to a different direction; 2) absorption, where a plane wave's amplitude is significantly reduced; 3) focusing/collimation, where a plane wave is focused to a single point or a spherical wave from a point source is converted to a single plane wave; and 4) polarisation modification, where reflection, refraction, focusing, or collimation involves altering. The incident signal from the transmitter is reflected by the RIS panel. The RIS alters the channel environment from the transmitter to the receiver from the viewpoint of a wireless communication system with a configurable phase shift on each element. The resultant channel between the transmitter and receiver now consists of two parts: the direct channel, which bypasses the RIS, and the channel that interacts with the RIS. A specific metric aim, such as the system attainable rate or the coverage, can be maximised by altering the channel environment by using suitable designs for the RIS phase shifts, amplitudes, or both. In contrast to normal wireless communication research, where the design and optimization options are limited to the pair of transceivers, this is fundamentally different [1,5].

A one-bit on-off switch has been devised as a straightforward RIS arrangement. Both the on state, when the signal is reflected, and the off state, when the signal goes through the element, are possible configurations for each surface element. The incident signal's phase shift cannot be adjusted in the design for reflection. The RIS may produce power increase on the order of N2, where N is the number of elements in the RIS, by using an appropriately created on-off selection technique. However, there is little opportunity to alter the reflected beam pattern for a far-field incident radio wave with an optimal on-off RIS. The strength of the signal that is reflected and travels to the user's location may be rather strong. The reflection coefficients of the surface components may be dynamically changed with discrete phase or amplitude states by applying control voltages to a specific PIN diode. More regulated variables provide for greater design flexibility. As a result, better performance is possible. However, a significant rise in complexity is one of the drawbacks of this group. Another possibility in this group is that the phase shift regulates the amplitude. The surface element's reflection amplitude coefficient, as indicated in, depends on the preset phase shift. Although the amplitude cannot be customised individually in this situation, it may be designed through phase consideration by simultaneously taking the channel's effects on the amplitude and phase-shift into account [2,4].

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Conflict of Interest

The authors reported no potential conflict of interest.

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