

China Academy of Telecommunication Technology ■

3GPP TSG RAN Rel-19 workshop

Taipei, June 15-16, 2023

RWS-230377

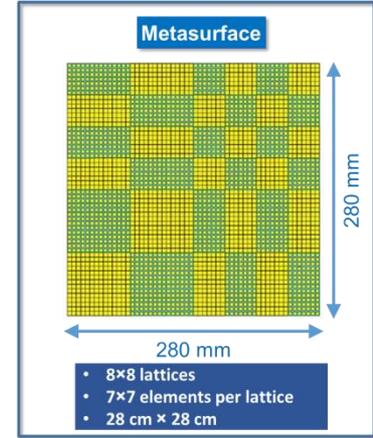
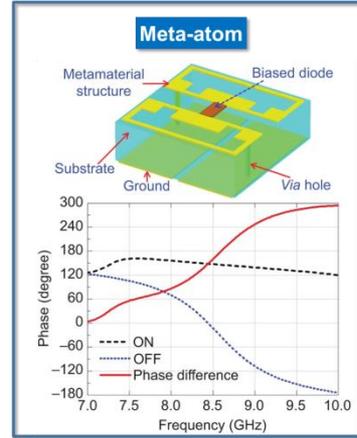
Reconfigurable Intelligent Surface(RIS) based wireless transmission system for NR

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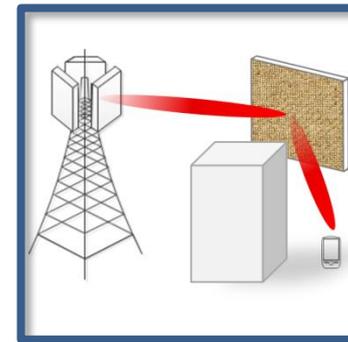


Background

- Reconfigurable intelligent surface (RIS) has attracted much attention due to its low cost and energy consumption, small volume, light weight, programmability, and ease of deployment
- RIS can be deployed as reflective panels to reflect signals
- Deployment of RIS can expand the coverage of each cell to avoid frequent cell handovers and overcome shadowing effects
- With RIS, expected spatial propagation characteristics can be deliberately constructed, and the degrees of freedom of wireless channels can be effectively improved



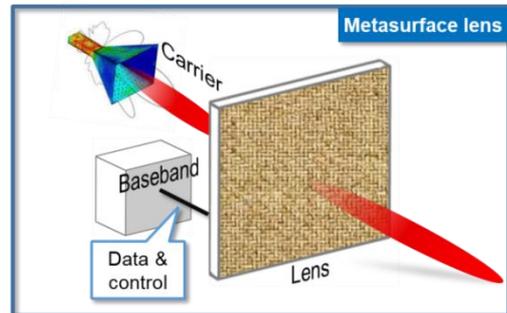
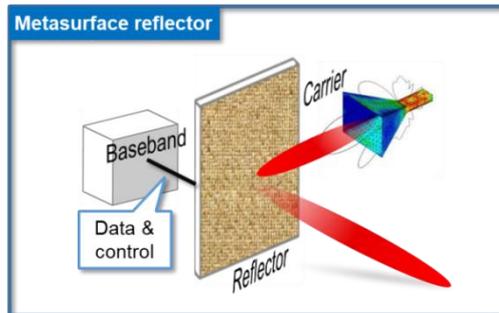
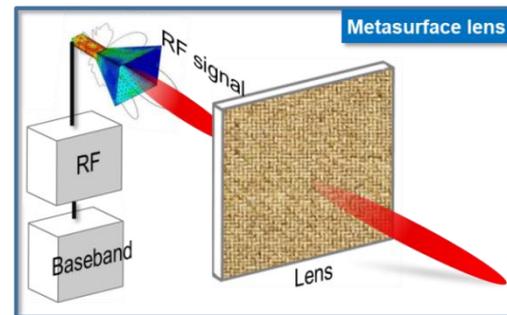
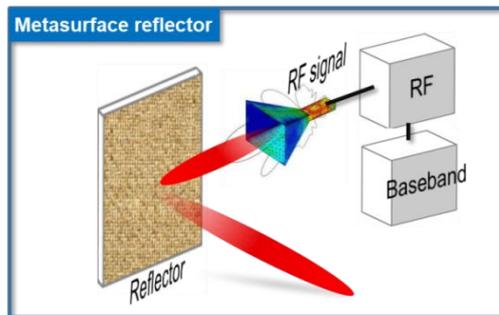
Cui T J , Qi M Q , Wan X , et al. Coding metamaterials, digital metamaterials and programmable metamaterials[J]. Light Science & Applications, 2014, 3(10):e218.



RIS relay

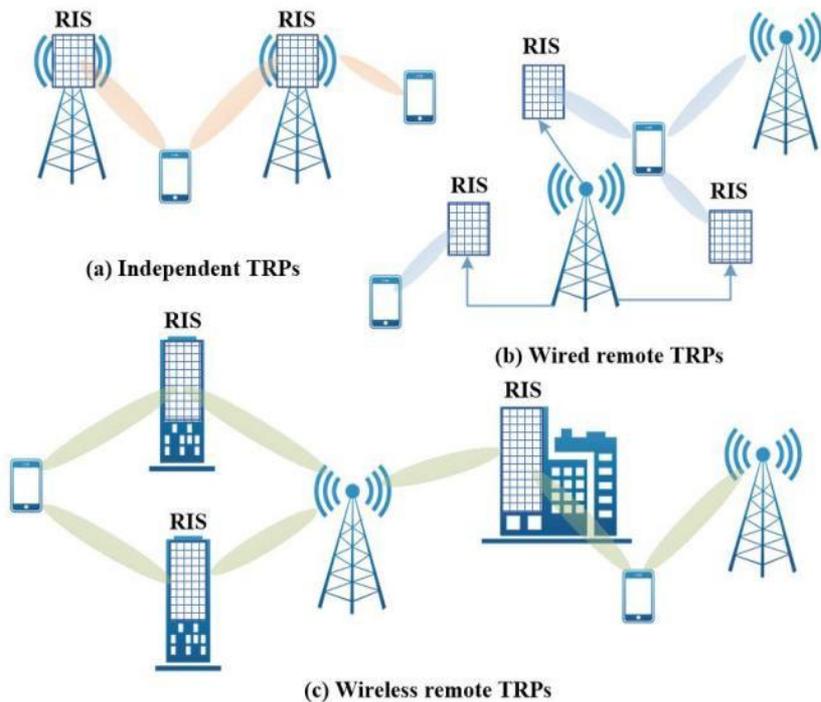
Localized massive MIMO based on RIS

- RIS can also be used to replace analog array in traditional hybrid beamforming architecture
- By using RIS, the number of components like RF chains, phase shifters, and power amplifiers is reduced, the cost and energy consumption of the transmitter decline
- Modulation and beamforming can even be achieved simultaneously by space-time coding on RIS



Distributed massive MIMO based on RIS

- In distributed massive MIMO system, RIS arrays are deployed separately in multiple transmit and receive points (TRPs) located in different locations. For example,
- (a): Independent TRPs composed of RF and RIS
- (b): TRPs with wired remote radio units (RRUs) composed of the feeder and RIS
- (c): Beams reflected from multiple RISs can be utilized in coordinated multiple points transmission/reception (CoMP).



Channel modeling of RIS

Stage 1: Without element-level modeling of RIS

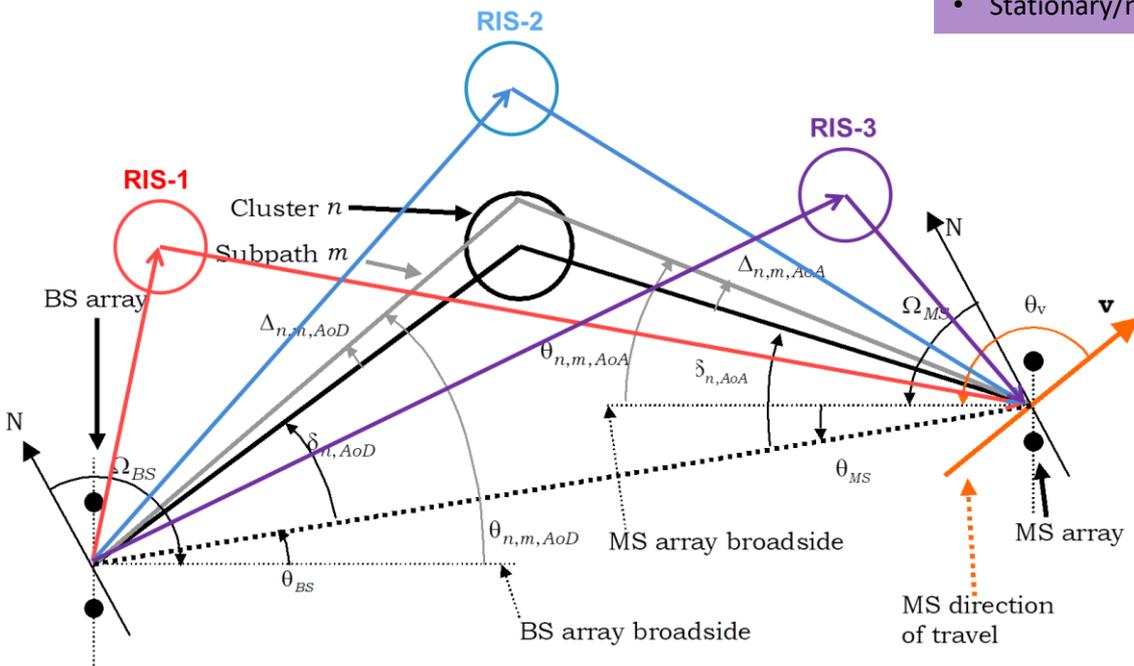
- Modeling of the composited channel with RIS
- Typical deployment scenarios
 - RIS deployed close to BS (e.g. Tx array)
 - RIS deployed close to UE (e.g. Rx array)
 - RIS deployed in the middle of BS-UE link (e.g. relay)

Stage 2: With element-level modeling of RIS

- Radiation pattern of RIS element is modeled
- Only stationary far field modeling is considered

Stage 3: Complete modeling of RIS

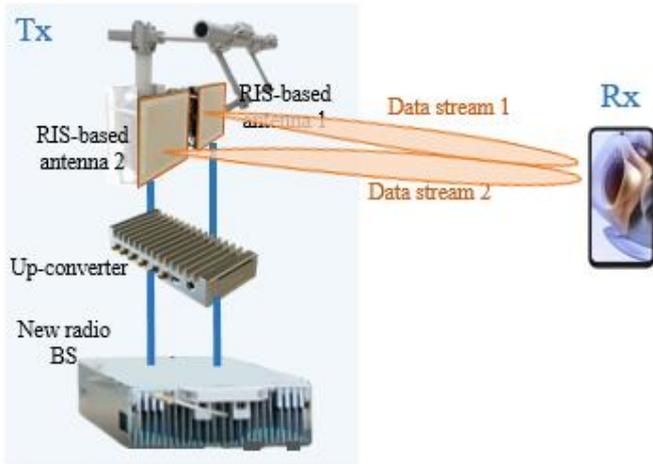
- Radiation pattern of RIS element is modeled
- Stationary/non-stationary far/near field modeling



Field measurement platform of RIS

RIS-based massive MIMO prototype

- Support dual-layer massive MIMO transmission with NR base station & UE
- Number of elements/panel: 1024
- Carrier frequency: 26.6GHz
- Bandwidth: 800MHz



Potential areas of study

- Channel measurement and modeling
 - Scenario models
 - Indoor, outdoor, O2I, etc.
 - LoS/NLoS
 - Far field, near field
 - Array models
 - Modeling of different RIS structures
 - Modeling of radiation patterns
 - Considered links
 - BS-RIS
 - RIS-UE
 - BS-UE
 - Methodologies
 - Geometry-based stochastic models
 - Map-based/ ray-tracing
 - Hybrid models
- Air interface
 - Access/backhaul links
 - Synchronization & broadcasting
 - Beam management for BS-RIS/RIS-UE/BS-UE links
 - CSI enhancement
 - Inter-cell interference mitigation
 - Coordination transmission/reception based on RIS

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