PREFACE

Next-generation wireless communication systems are expected for high spectral and energy efficiency, colossal data rate, low latency, and massive connectivity. This is because of an exponential increase in mobile traffic, mobile devices, and new disruptive services and applications. Recently, reconfigurable intelligent surface (RIS) and nonorthogonal multiple access (NOMA) methods have been explored to enhance spectral and energy efficiencies. A RIS, also known as intelligent reflecting surfaces (IRS), has equipped a large number of low-cost passive reflective elements. Each reflecting element smartly tunes the phase of the incident signals according to the channel environment and the reflected signals can be constructively added to enhance the signal-to-noise (SNR) towards receivers. On the other hand, NOMA is the latest member of the multiple access technique, which supports more users at the same time/frequency/code with different power levels assigned according to their channel gains. Further, NOMA yields an effective achievable rate over the conventional orthogonal multiple access (OMA).

Hence, the mutual benefits of RIS and NOMA can satisfy the demand for massive connectivity, low latency with higher energy, and spectral efficiency for next-generation wireless networks. Moreover, in downlink RIS-assisted index modulation-NOMA (R-INOMA), the BS transmits the information through RIS to three users. The first user (cell-edge user) is assigned in the spatial domain, and the remaining two users are multiplexed with power domain NOMA (PD-NOMA). Further, the investigated upper-bound bit error probability (BEP) of INOMA users, is achieved that at low transmit power, higher received SNR under the Rayleigh fading channels and enhanced the cell-edge performance.

Furthermore, multiple RISs can be created a virtual line-of-sight (LoS) channel between the base station (BS) and users to improve the network coverage and received SNR, especially in high frequencies and severe path attenuation scenarios. Since millimeter-wave (mmWave) and terahertz (THz) frequencies suffer higher path loss

due to molecular absorption and the LoS path is blocked. Additionally, the implemented joint optimization of transmit antennas beamforming and reflecting elements phase beamforming at BS and RIS, respectively, enhance the performance of more users which are distributed at the cell edge than in the cell center scenario.

Next, the author has reported the present work in a timely in reputed journals, namely, IEEE Communication Letters, Transactions on Emerging Telecommunications Technologies, and International Journal of Communication Systems.

The author will consider his modest effort as a success if it would be useful to the community of wireless communications designers and researcher.