RIS Footprint Pattern Shaping for Next-Generation Wireless Coverage Control

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The paradigm of "Smart ElectroMagnetic Environment" (*SEME*) has emerged in the last few years as a cornerstone for the development of future wireless communications systems [1]. Within the *SEME* framework, the environment propagation is no longer an incontrollable part of a wireless system, but it can be modified/optimized for the purpose of enhancing the communication effectiveness [1]. The availability of "ElectroMagnetic Skins" (*EMS*) with user-defined wave reflection capabilities is one of the core technologies enabling such a revolutionary approach to be implemented in practice [2][3], together with more complex and expensive solutions such as integrated access and backhaul nodes [5] and smart repeaters [6]. As such, several different *EMS* concepts are being developed by the academic and industrial communities, ranging from static-passive *EMS* [2] to reconfigurable-passive *EMS* and reconfigurable intelligent surfaces (*RIS*) [3].
Within this scenario, this invited talk is aimed at illustrating the recent advances and current trends in the field of *RIS*-enabled complex wave manipulation. The possibility to overcome the field control properties of current generation *RIS*s (often capable only of anomalous beam focusing) will be discussed, and the possibility to achieve unprecedented beam contouring features with inexpensive digital *RIS* architectures will be addressed.
Preliminary numerical results will be presented to illustrate the wave manipulation capabilities and efficiency enabled by the proposed approaches (see Fig. 1 for an illustrative test case involving a 30x30 RIS).

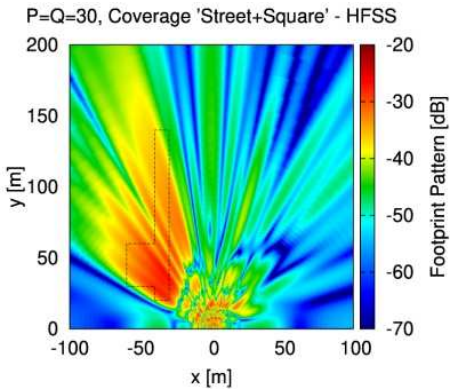

Figure 1. *Illustrative Example* (30x30-cell *RIS*, single-bit control) – HFSS-simulated footprint power pattern.

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