Politecnico di Torino

Finanziato dall'Unione europea NextGenerationEU

# ELECTRICAL, ELECTRONICS AND COMMUNICATIONS ENGINEERING

## PNRR - Design of Curved Electromagnetic Skin

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| **Funded By** | MINISTERO DELL'UNIVERSITA' E DELLA RICERCA [P.iva/CF:97429780584]<br>Politecnico di TORINO [P.iva/CF:00518460019] |
| **Supervisor** | PIRINOLI PAOLA - paola.pirinoli@polito.it |
| **Contact** | PIRINOLI PAOLA - paola.pirinoli@polito.it |
| **Context of the research activity** | Smart Electromagnetic Skins (SESs) are surfaces able to perform controlled manipulation of an incident field. To increase their integrability in the environment, the proposed activity is focused on the design, numerical and experimental characterization of innovative and highly performing curved SESs to be mounted on street or stop light poles. The activity will involve aspects related to both their design and technological aspects, including the study of new materials and solutions for the manufacturing.<br><br>PNRR M4C2, Investimento 1.3 - Avviso n. 341 del 15/03/2022 - PE0000001 RESearch and innovation on future Telecommunications systems and networks, to make Italy more smart (RESTART) - CUP E13C22001870001 |
| | The next generation of communication systems are expected to provide very fast data transfer, extremely low latency, ubiquitous mobile ultra-broadband connectivity, seamless coverage, and reduced power consumption, necessary requirements to face the increase of data traffic and to allow the introduction of new applications, asking for improved coverage and high quality of service, especially for the connection with mobile devices. To satisfy these criteria, the use of the mm-wave frequencies presents several advantages, even if the larger attenuation and stronger interaction with obstacles along the propagation path can cause a degradation of the services in those regions not in the line-of-sight of the base station antennas. To avoid the use of their massive number, the idea of using the environment where the propagation occurs as a further degree of freedom of the wireless network is exploited.<br>This is possible thanks to the use of the Smart Electromagnetic Skins (SESs), which are very thin surfaces, in most cases planar, that can be integrated into the environment for which they are designed. They consist of many elements with resonant or sub-wavelength size, able to provide an |

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| **Objectives** | anomalous reflection: in this way, the incident field is re-directed in a predefined direction or covers the desired area. Depending on their operating principle, SESs can be static surfaces, i.e. completely passive surfaces designed to provide predefined coverage once their positions and that of the base station are known, or dynamically reconfigurable surfaces, in which it is possible to change the reradiating direction just by adjusting the behavior of the surface itself by the introduction of elements that could be reconfigured.<br>In addition to guaranteeing the improvement of the wireless network performance, SESs must also satisfy other constraints as the reduced environmental impact. A reasonable solution is their integration on the wall of buildings, but this option is not always achievable for several reasons.<br>The proposed activity is focused on the study of alternative solutions, suitable to overcome this problem, as the possibility of exploiting street furniture and fixing (static) SESs for instance to street or stop light poles. To reduce the visual impact that such a solution might have, or to allow the SES to be illuminated by the field arriving from different base stations, it would be preferable to use a curved instead of a planar reflecting surface. The introduction of the curvature affects the re-radiating properties of the SESs, and therefore it has to be taken into account in their design.<br>The activity is therefore first focused on the possibility to design this kind of structures keeping as high as possible their performance. Moreover, also technological aspects are investigated, considering innovative materials and techniques for curved SESs manufacturing. |

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| **Skills and competencies for the development of the activity** | Outstanding math ability and programming skills; profound knowledge of electromagnetics; ability to learn new things; fresh graduation is preferred. |