

WIDEBAND AND MASSIVE MIMO TECHNOLOGIES FOR 6G

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Research Group: Signal Processing in Communications Group

The Signal Processing in Communications Group (GPSC) is specializing in the theoretical foundations and practical applications of statistical signal processing. Our core expertise lies in developing mathematical models and algorithms to solve complex problems in two main areas: digital communications - including wireless communications and satellite systems - and multimedia security. The group's activity is characterized by a balance between fundamental research and technology transfer, supported by a portfolio of over €9 million in competitive funding.

The group counts with a strong network of top international collaborators in academia and industry, offering possibilities for research stays and internships. Many PhD alumni of the group have achieved positions in industry-leading international tech companies, as well as top academic and government institutions in Europe.

Keywords: Hybrid Beamforming | Integrated Sensing and Communications | mmWave | Orthogonal Delay-Doppler Modulation | Non Orthogonal Multiple Access

Research Focus:

This research focus aims to develop wireless signal processing and network architecture solutions that exploit situation awareness and machine intelligence to enhance communication services in support of next generation wireless services. The project will study both improvements in radio resource management protocols and schedulers leveraging sensing information, as well as advanced waveforms and channel estimation algorithms that permit the extraction of perceptive information from the communications signal. Such goals are key trends in future mobile cellular 6G and WLAN WiFi 8 standards.

Depending on their technical specialization, the selected candidate will contribute to the project in one or more of the following topics: i) Advanced signal processing algorithms for beyond 5G wireless systems, including compressed sensing channel modeling and estimation, multicarrier modulations with mobility, and hybrid beamforming for massive MIMO mmWave systems. ii) Advanced technologies for Integrated Sensing And Communications (ISAC) including location algorithms, joint

estimation and reception, channel scenario ray-tracing, and training sequence and waveform design iii) Advanced Radio Resource Management in wireless networks, including limited feedback channel state information, link adaptation, precoder selection, multi-user scheduling with spatial multiplexing, with joint detection or interference canceling, and user attachment and routing in multi-hop and D2D topologies. iv) Development of Open Source tools for communications research, including standard 3GPP channel multipath model, ray-tracing simulations, full-stack 5G network simulation, and the O-RAN 5G industry standard. v) Application of Machine Learning technologies to communications systems in the PHY and MAC layers, with emphasis on sparse multipath channel estimation, mobile user location, massive MIMO beam management and multi-user scheduling or resource allocation.