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ECOLE NATIONALE POLYTECHNIQUE

ENP-YTU-IMU Joint Workshop
on Telecommunications and Array Signal Processing

AMPHI OUABDESSELAM, ENP
December 1st, 2025

Program:

9h00	Registration
9h30	Welcome by the Director of Ecole Nationale Polytechnique, Prof. Dr. Abdelouahab Mekhaldi,
9h40	Word by the Head of the Turkish delegation, Rector Prof. Dr. Eyüp Debik, Yıldız Technical University
9h50	''Are we ready for 6G vision? What is next? Flexible and cognitive radio access technologies for 5g and beyond'', Prof. Dr. Huseyin Arslan, Istanbul Medipol University
10h35	''Non-stationary Signal and array processing'', Prof. Dr. Adel Belouchrani, Ecole Nationale Polytechnique
11h20	Questions and Debate
12h00	Closing

First Talk: Are we ready for 6G vision? What is next?
Flexible and cognitive radio access technologies for 5g and beyond

Prof. Dr. Huseyin Arslan, Istanbul Medipol University
Professor, IEEE Fellow, Dean of Faculty of Engineering at Istanbul Medipol University,
Member of Turkish Academy of Science

Today's wireless services and systems have come a long way since the rollout of the conventional voice-centric cellular systems. The demand for wireless access in voice and multi-media applications has increased tremendously. In addition to these, new application classes like extreme mobile broadband communication, ultra reliable and low latency communications, massive machine type communications, and Internet of Things have gained significant interest recently for 5G. The trend on the variety and the number of mobile devices along with the mobile applications will certainly continue beyond 5G, creating a wide range of technical challenges such as cost, power efficiency, spectrum efficiency, extreme reliability, low latency, robustness against diverse channel conditions, cooperative networking capability and coexistence, dynamic and flexible utilization of wireless spectrum.

With the rapid evolution of wireless networks across a broad technological environment which includes virtualization, IoT and Industry 4.0, our lives are surrounded by electronic devices capable of wireless radio transmission and reception, not only for communication purposes but also for radar, wireless sensing, and radio environment monitoring and mapping. Emerging Internet of Things (IoT) and Cyber-Physical Systems (CPS) applications aim to bring people, data, processes, and things together to fulfil our needs. With the emergence of software defined networks, adaptive services and applications are gaining more attention since they allow the automatic configuration of devices and their parameters, systems, and services to the user's context change. Granted, these devices, networks, and applications are huge commodities and improve our quality of life but they also present a major risk, not only because of the widely recognized security leaks in current wireless radio access technologies but also because of the enormous amounts of information over a medium which can be extracted by radio-based sensing.

More than anything, 5G and beyond has introduced a new vision and sets of challenges for wireless researchers in many layers of the protocol stacks, especially in the Physical and Medium Access Layers. In order to address these technical challenges, highly flexible and adaptive radio access technologies are needed. Hence, 5G and beyond is about flexibility and applications. 5G and beyond is expected to bring about a communication system (with a single standard) through very flexible and cognitive design to support wide variety of services. As a result, the wireless radio researchers are facing a new challenge, which is the design of a flexible communication system in every layer of the communication protocol stacks. In this talk, the flexibility and adaptability of 5G and beyond systems will be discussed with a major focus on PHY and MAC layers. The potential directions and research opportunities to address the challenges and requirements of the 5G and beyond vision will be discussed.

Second Talk: Non-stationary Signal and array processing

Speaker: Professor Adel Belouchrani, Ecole Nationale Polytechnique, Algiers.
IEEE Fellow, Member Fellow of The World Academy of Sciences (UNESCO-TWAS),
Member Fellow of the African Academy of Sciences (AAS),
Founding Member of the Algerian Academy of Science and Technology (AAST)

Extension of conventional time-frequency analysis to data arrays has enabled dedicated array processing of non-stationary signals though synergistic development of advanced tools by exploiting the joint properties of time-frequency analysis and array signal processing methods. Conventional array signal processing assumes stationary signals and mainly employs the covariance matrix of the data array. This assumption is motivated by the crucial need in practice for estimating sample statistics by resorting to temporal averaging under the additional hypothesis of ergodic signals. When the frequency content of the measured signals is time varying, i.e. non-stationary signals, this class of approaches can still be applied. However, the achievable performances in this case are reduced with respect to those that would be achieved in a stationary environment. Instead of considering the non-stationarity as a shortcoming, Time Frequency Array Processing takes advantage of the non-stationarity by considering it as a source of information in the design of efficient algorithms in such environments. The talk deals with the relationship between Quadratic time-frequency distributions and array signal processing methods. The speaker plans to address a broad audience with general background in mathematics.