

Ivan Iudice

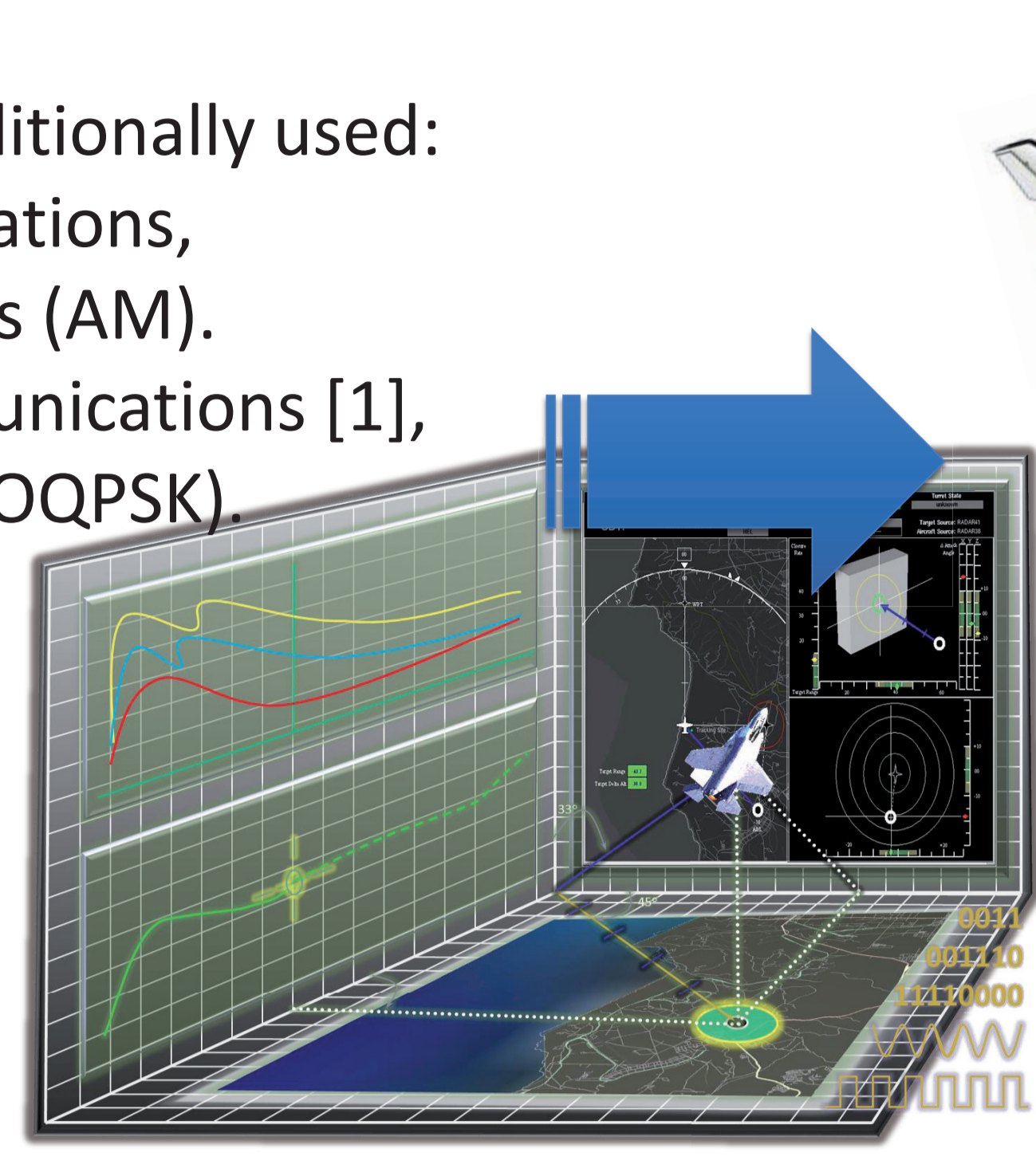
Tutor: Prof. Giacinto Gelli

XXIX Cycle - II year presentation

Advanced communication techniques for aerospace

Communication methods traditionally used:

- ☐ Voice: Analog communications,
 - VHF, UHF and HF bands (AM).
- ☐ Telemetry: Digital communications [1],
 - L, S, C bands (CPFSK, SOQPSK)



A **Reconfigurable Data-Link (RDL)** that is able to adapt its properties on the basis of the environment could be used to satisfy requirements.



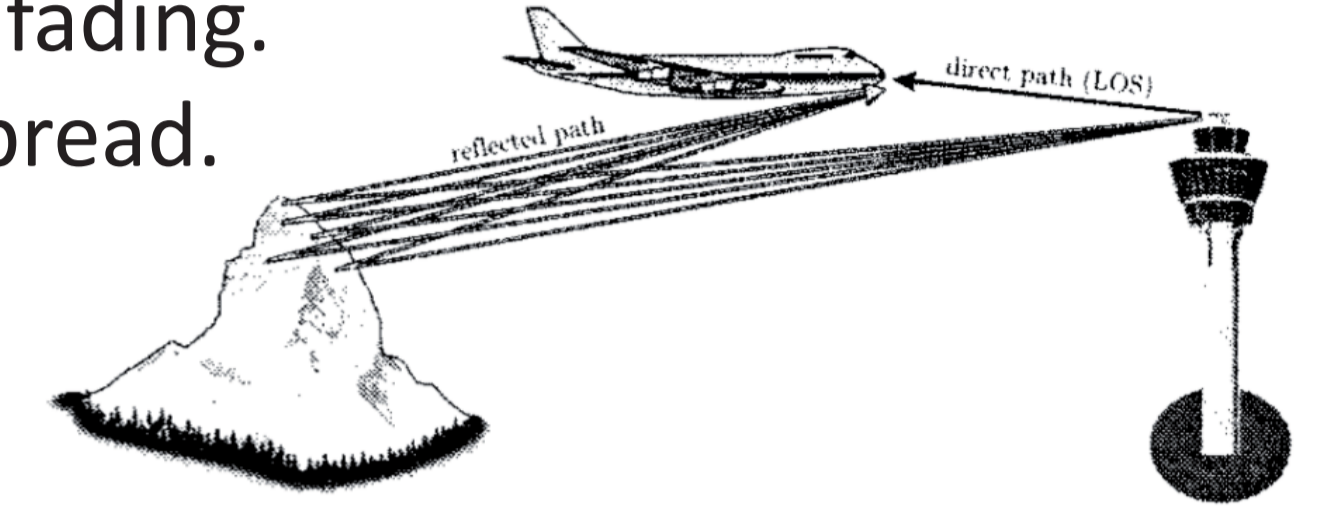
UAS or RPAS requirements:

- ☐ High data-rate.
- ☐ High reliability.



Channel usually exhibits [2]:

- ☐ Multipath fading.
- ☐ Doppler spread.



CPM optimal (ML) detector is the MLSDD:

- ☐ High complexity (VA can be utilized).

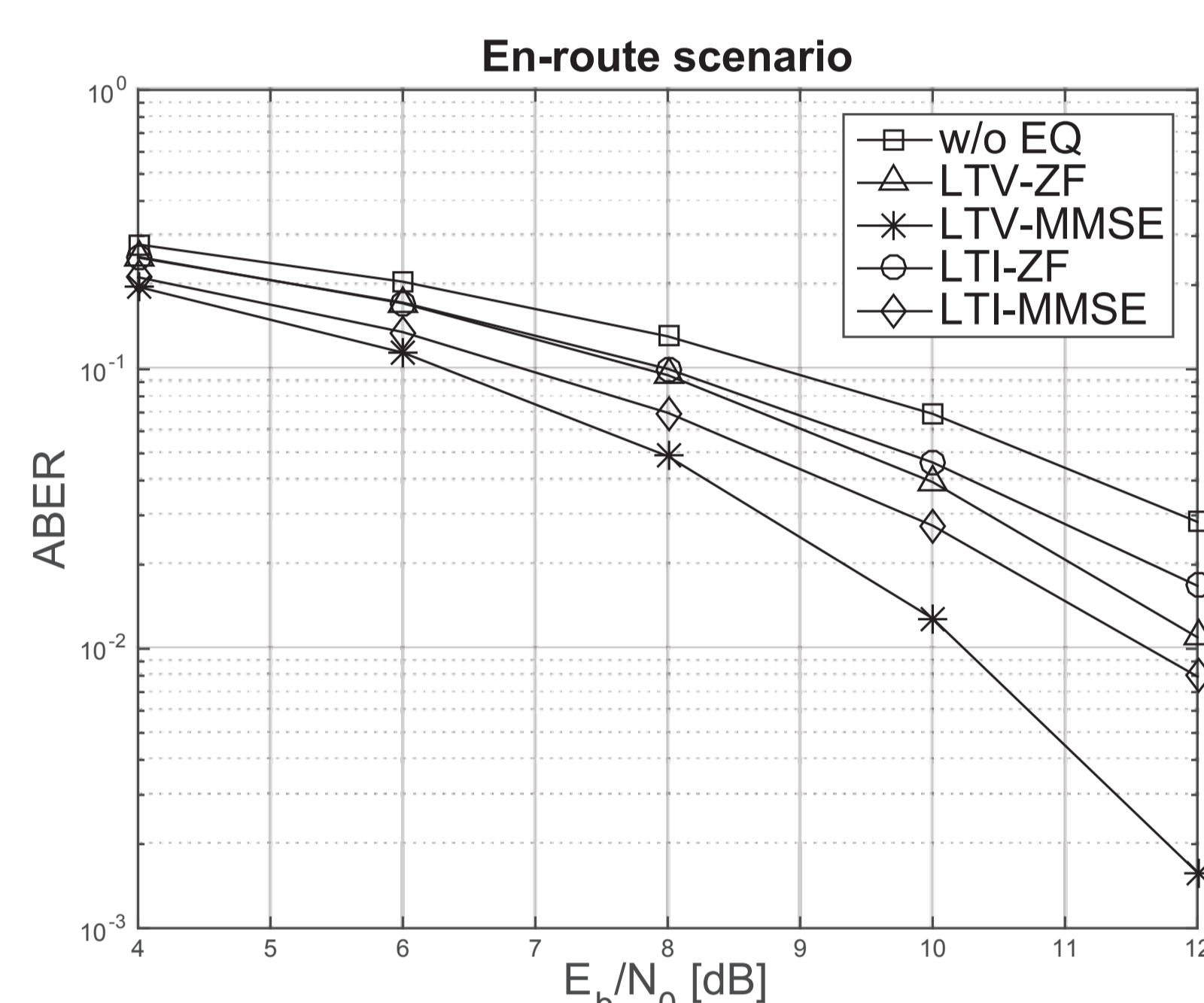
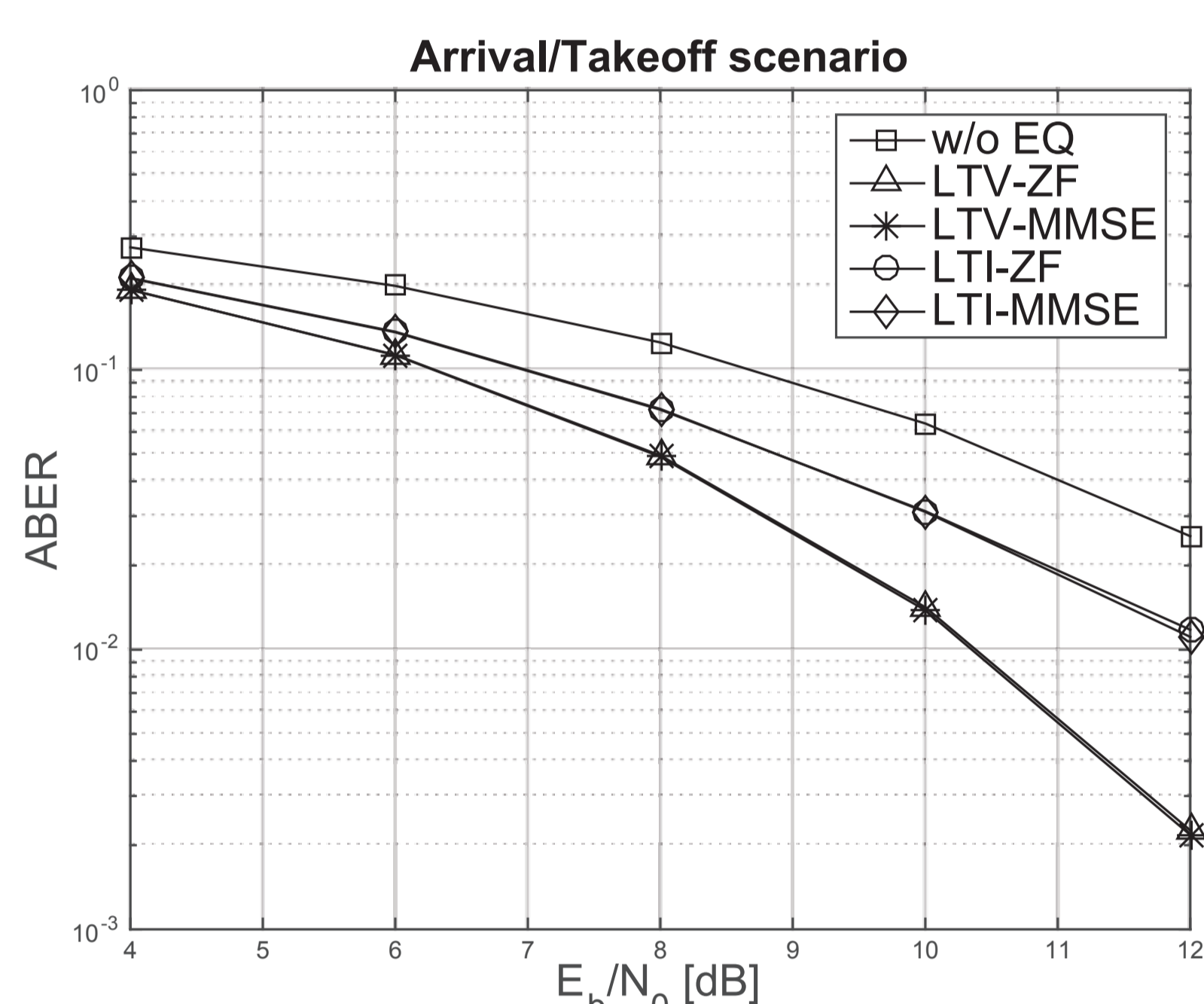
Due to **doubly-selective channel**, optimal detection becomes prohibitive:

- ☐ Huge **number of states** of the VA.
- ☐ Needs **fast channel estimation** and tracking.

Popular approach to reduce complexity [3]:

- ☐ Preliminary **LTI FDE**, and then VA detection.

We proposed **LTV equalizing approaches (LTV-ZF, and LTV-MMSE)** for **CPM signals** [7]



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Frequency-domain equalization (FDE) is not a viable strategy when the channel is **rapidly time-varying**, because it cannot be diagonalized by a channel-independent transformation [5].

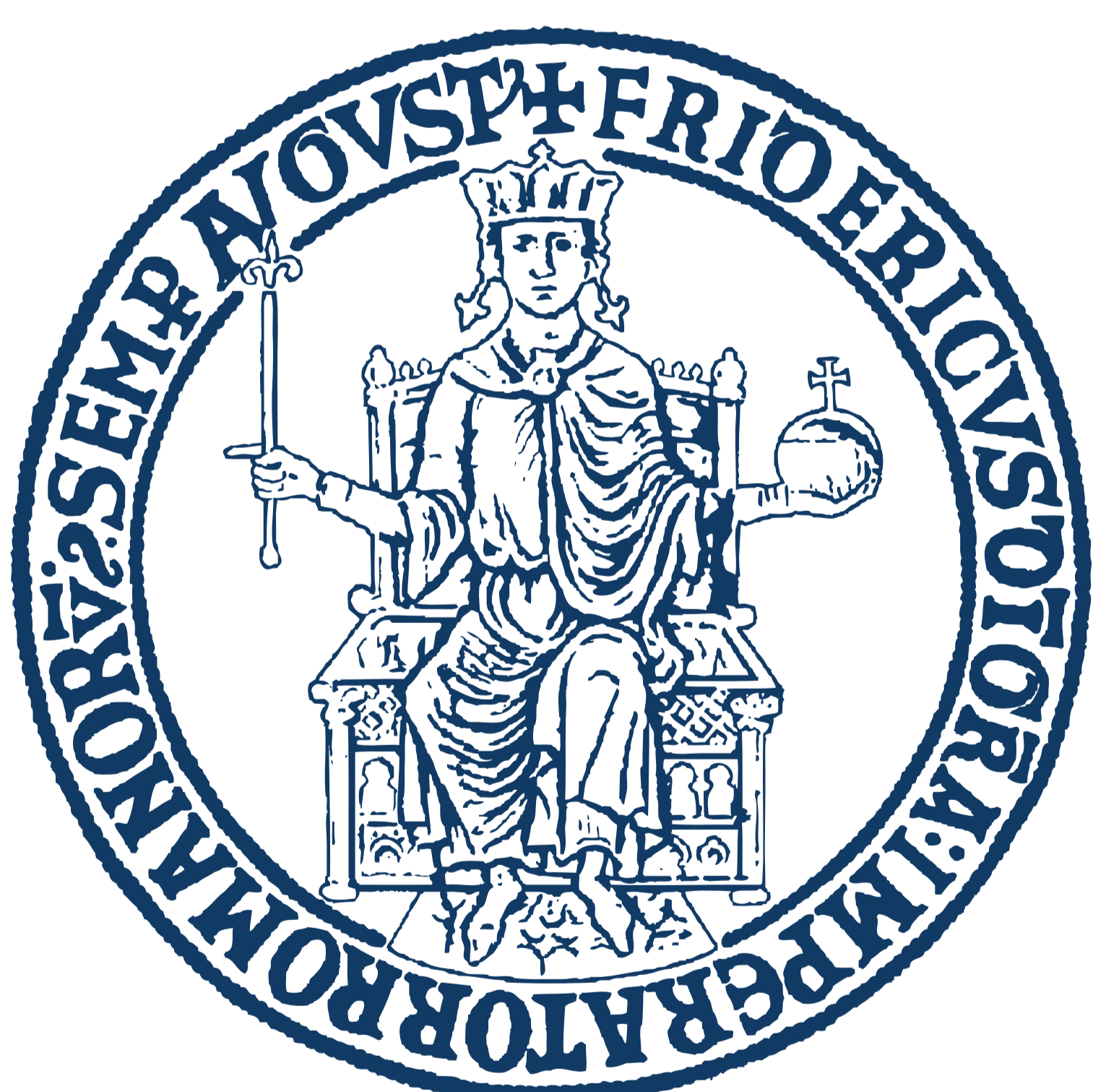
Future developments:

$$h(k, \ell) = \sum_{q=-Q_h/2}^{Q_h/2} h_q(\ell) \exp\left(j \frac{2\pi}{P} qk\right)$$

In the near future we will exploit the **basis expansion model (BEM)** [4] to obtain **low-complexity frequency-domain** implementation of the proposed LTV-ZF and LTV-MMSE equalizers [6].

References

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