

# SESIÓN 10 GCONVOLUTIONAL CODES

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## Code decomposition in the analysis of a convolutional code

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### Resumen

Some convolutional codes can be decomposed into smaller codes (subcodes). This happens if they admit decoupled encoders among its encoders [2]. We will consider such convolutional codes and study the relation between a code and its subcodes in terms of their free distances and column distances. It was shown in [1] that the free distance of a code is equal to the minimum of the free distances of its subcodes and we will show that the same happens with the corresponding column distances.

[1] J.-J. Climent, V. Herranz, C. Perea, *New convolutional codes from old convolutional codes, Electronic Proceedings of the 16th International Symposium on Mathematical Theory and Systems (MTNS2004)* (2004).

[2] E. Fornasini, R. Pinto, *Matrix fraction descriptions in convolutional coding, Linear Algebra and its Applications* (2004), 392, 119-158.

## Algebraic-Geometric constructions of convolutional codes

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### Resumen

The techniques proposed by V.D. Goppa for constructing Algebraic-Geometric codes (AG codes) over a finite field  $\mathbf{F}_q$  can be translated to the setting of convolutional codes over the field  $\mathbf{F}_q(\mathbf{z})$  of rational functions in a variable  $z$ . This discovery provides a systematic method for obtaining convolutional codes with prescribed properties, in particular, that attains the maximum free distance possible.

In this talk we explain the basic constructions of this AG convolutional codes, and propose a way to give a geometric interpretation of the parameters of convolutional codes.

# Construction of Convolutional Codes with a Designed Parameters from Linear System Viewpoint

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## Resumen

Coding theory is naturally partitioned into the study of block and convolutional codes. Convolutional codes generalize the class of block codes in a natural way. However, the algebraic theory of convolutional codes is not as advanced as the algebraic theory of block codes. In fact, more of the implemented convolutional codes were found by exhaustive computer searches. Some of the few algebraic constructions have extended construction for block codes to convolutional codes. Other procedures consist in constructing new convolutional codes from old ones. Two of these techniques are coding concatenation, which allows the use of multiple encoding stages to obtain long codes with only a linear increase in decoding complexity, and the punctured process, thus a low rate encoder can be used to generate many high-rate codes. Both techniques are treated in the literature from the generator matrix viewpoint. In this work, we present new convolutional codes with a fixed rate and degree using the concatenation and punctured techniques from the linear system viewpoint. We also establish a lower bound over the free distance of the obtained convolutional codes.