Journée des doctorants

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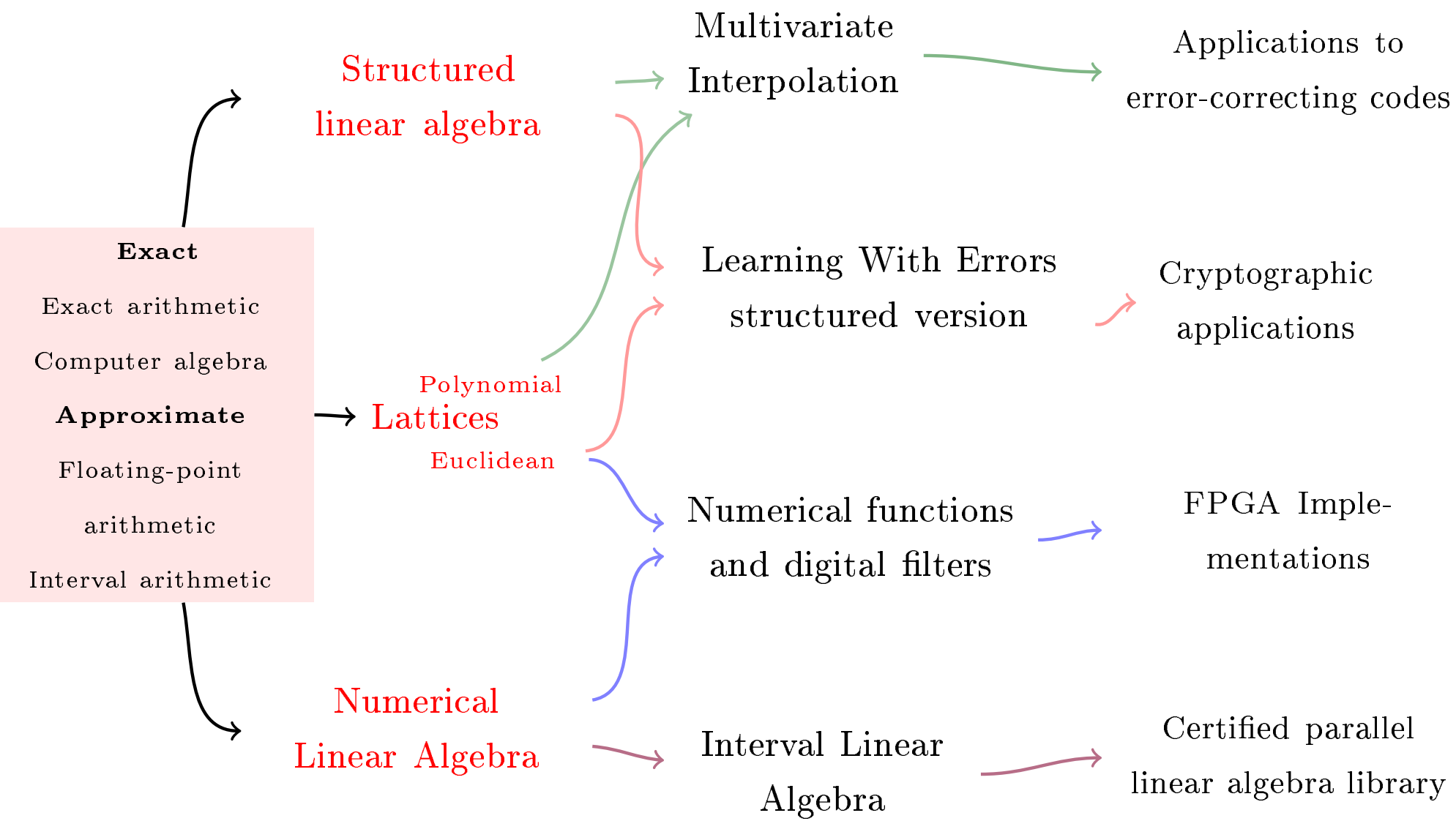
AriC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Interval arithmetic
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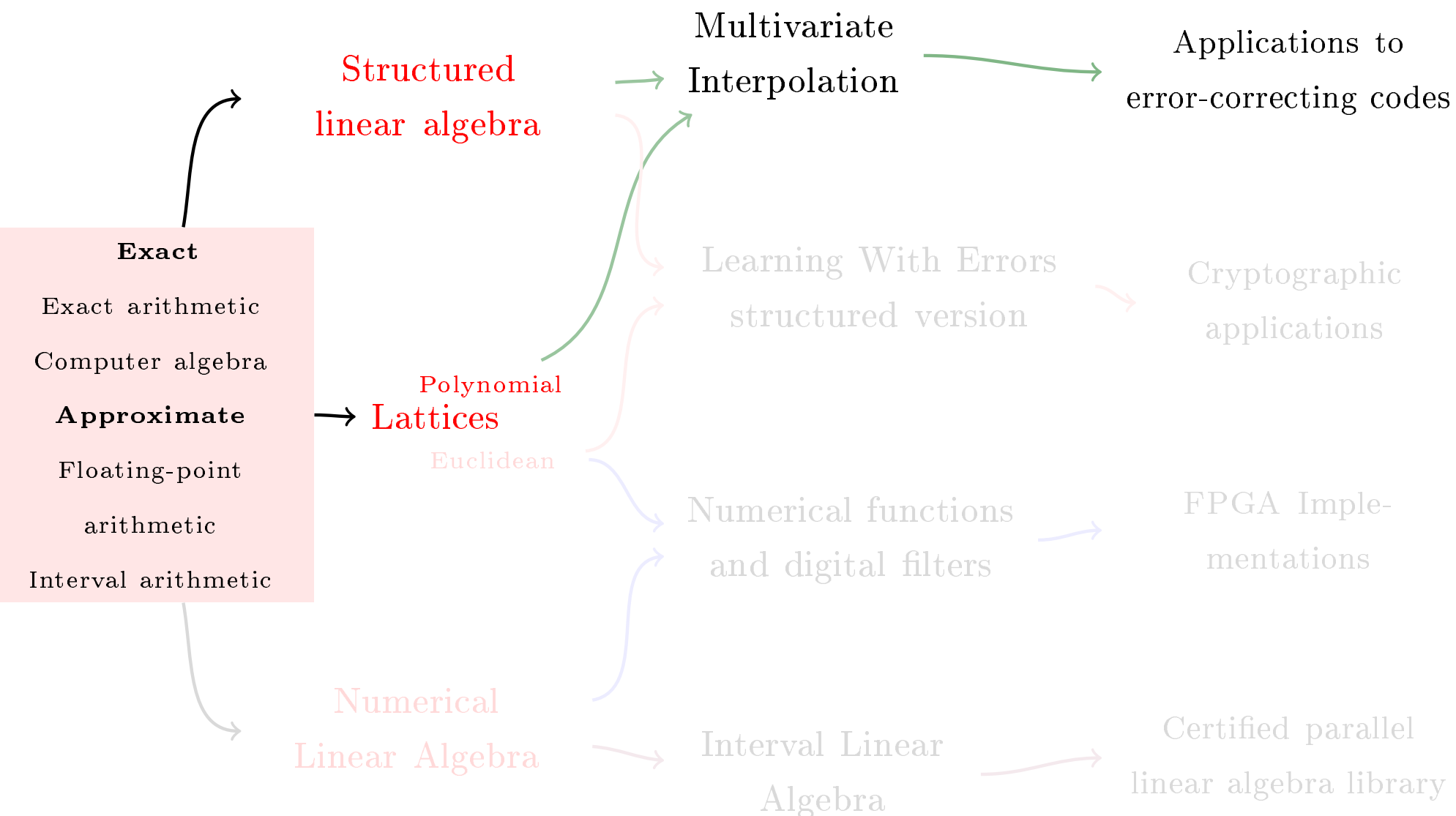
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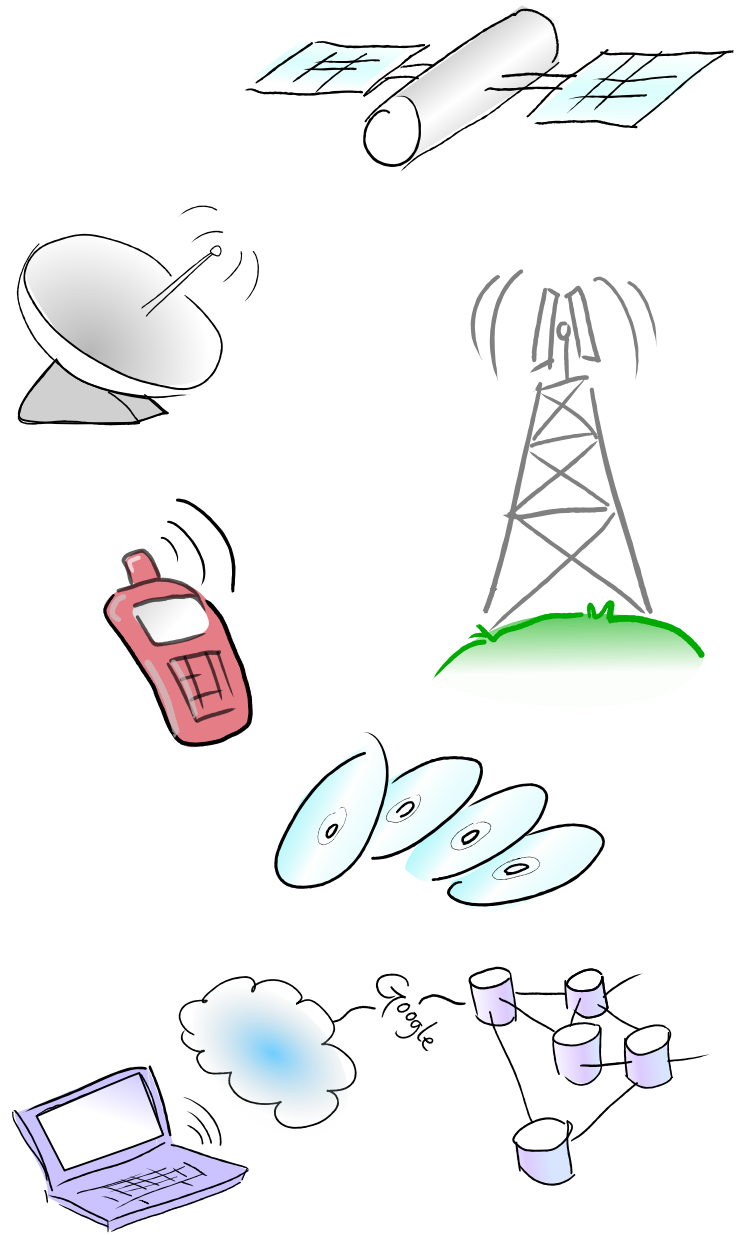
AriC — Error-correcting codes

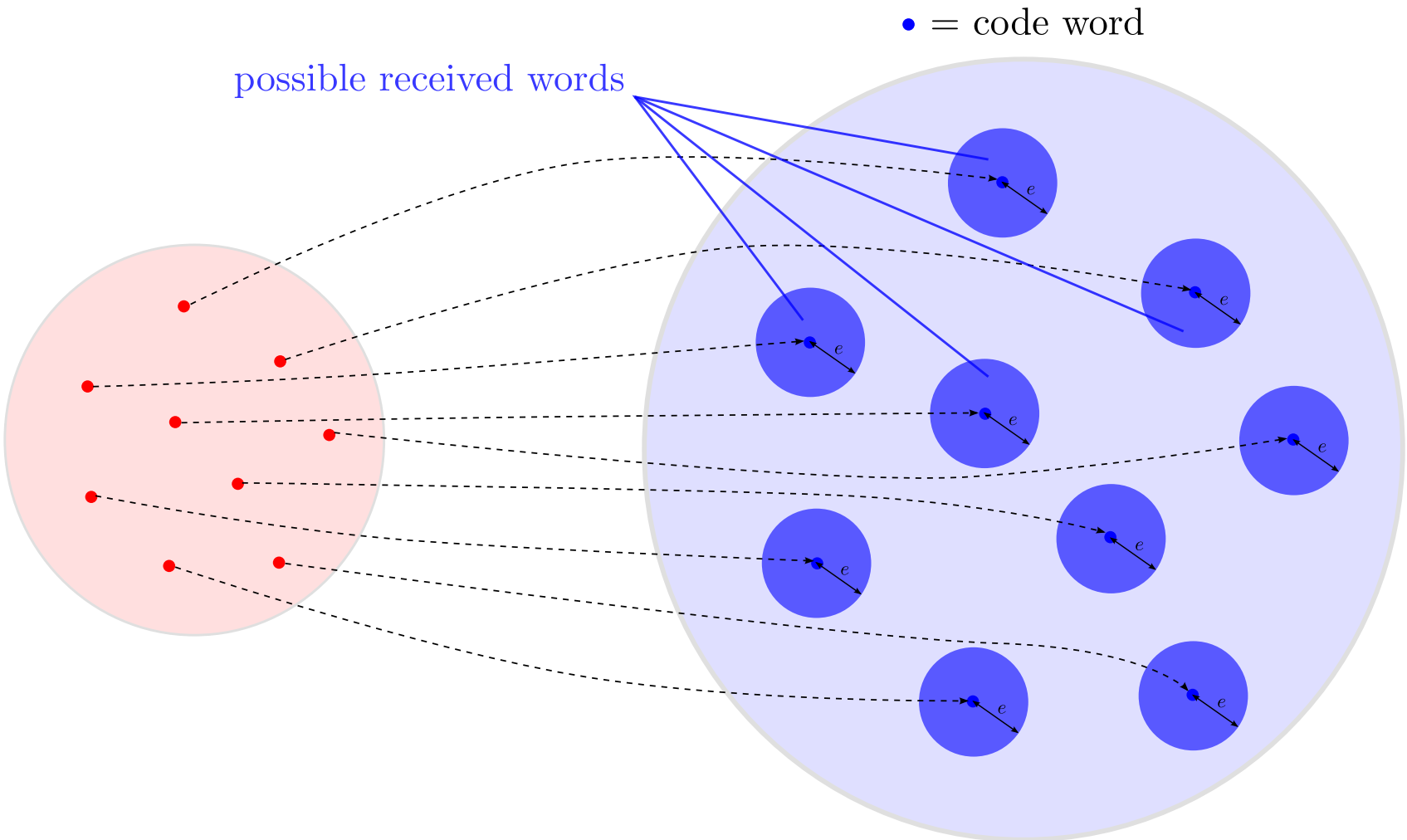
Goal:
Enable reliable delivery of data over unreliable communication channels

Strategy:
add redundancy to the message
add redundancy to the message
add redundancy to the message



(courtesy of J.S.R. Nielsen)

AriC — Error-correcting codes

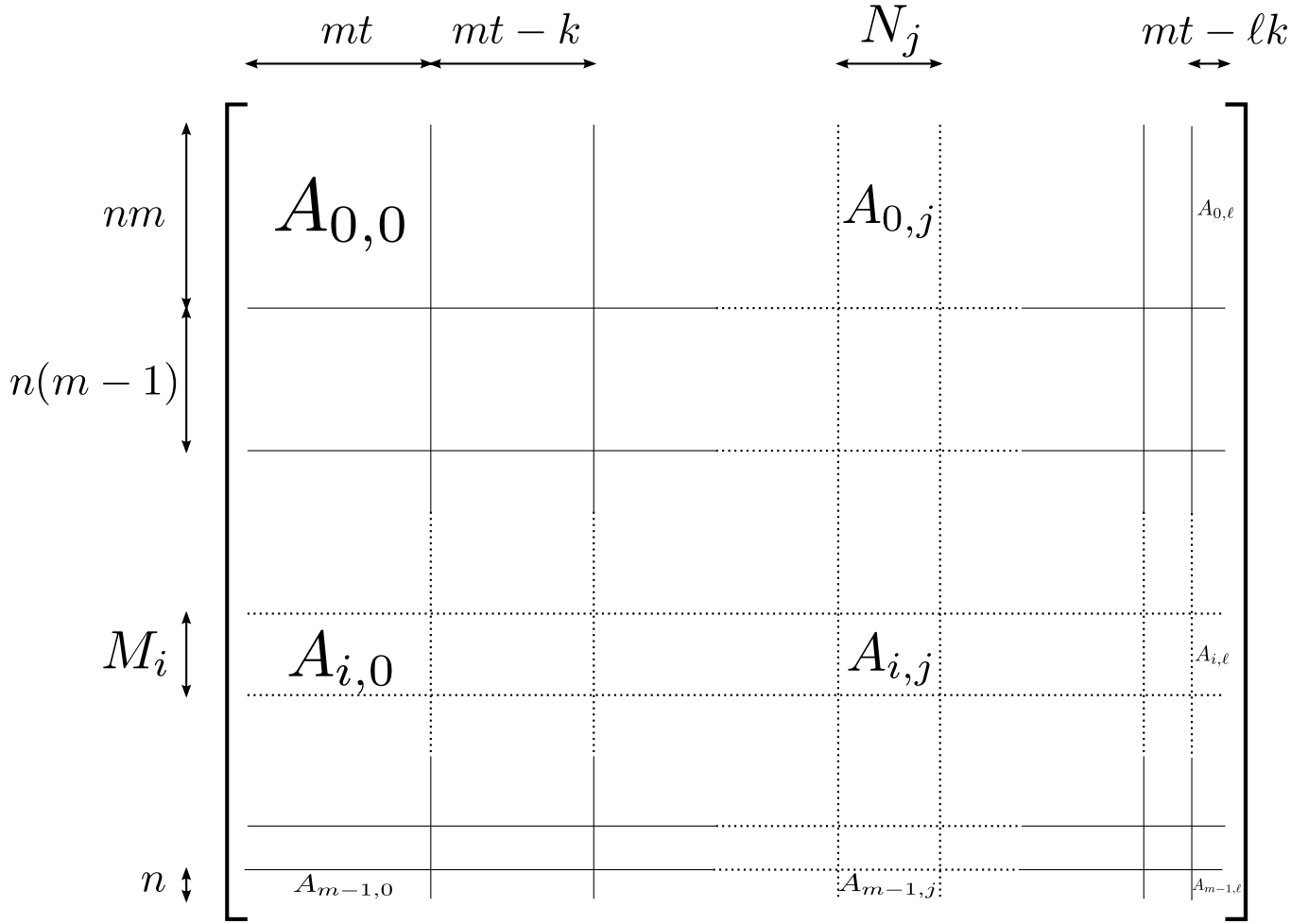


polynomials of degree $\leqslant k$ $\longrightarrow$ their evaluation at $x_1, \ldots, x_n$

$w = w_0 + w_1 X + \cdots + w_k X^k$ $(w(x_1), \ldots, w(x_n))$

AriC — (list-)Decoding

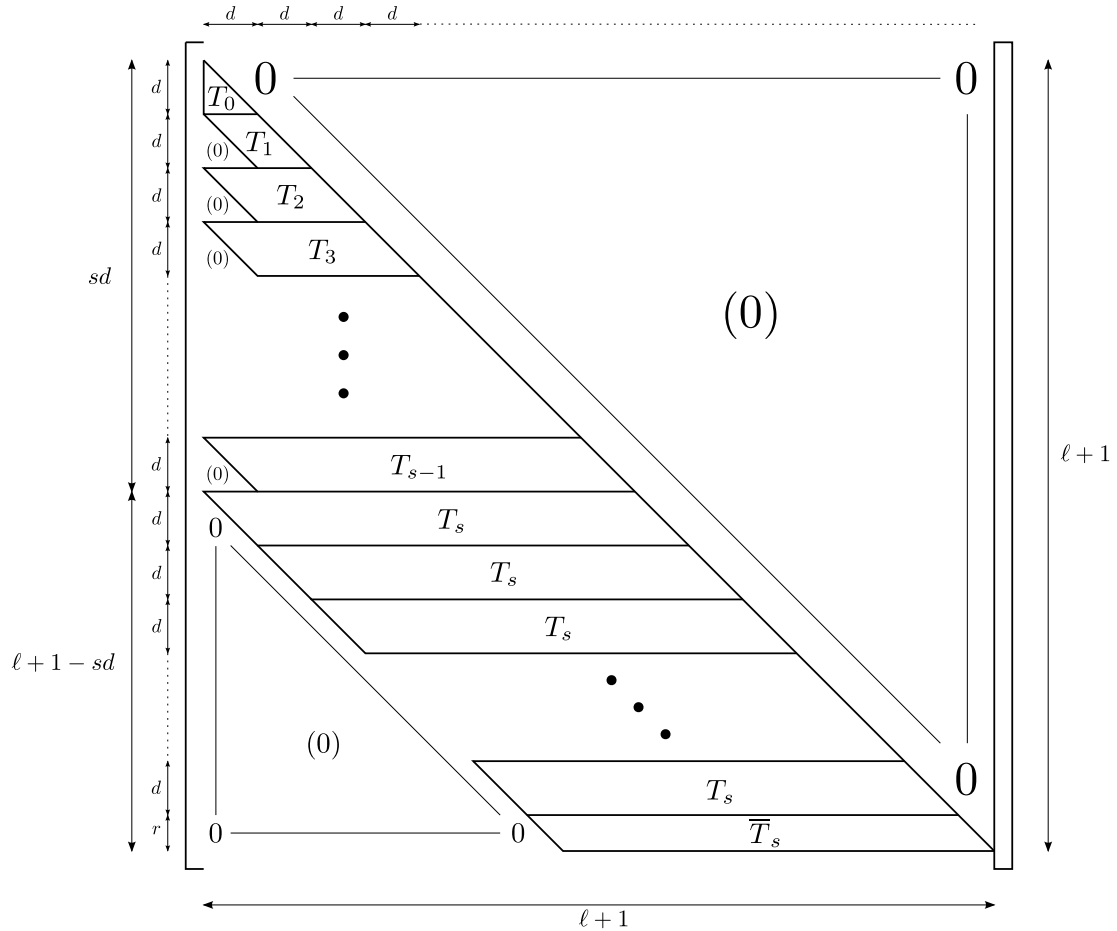
Find a solution of a structured linear system,



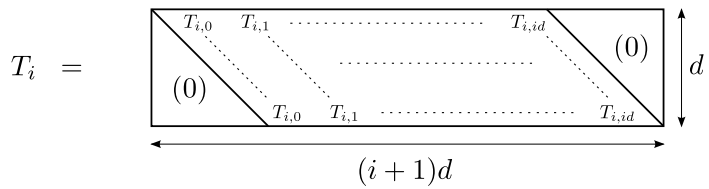
where $A_{i,j}$ is a Toeplitz / Hankel / Vandermonde / ... matrix

AriC — (list-)Decoding

Find a short vector in a (structured) polynomial lattice,



where T_i has a **Toeplitz** structure:



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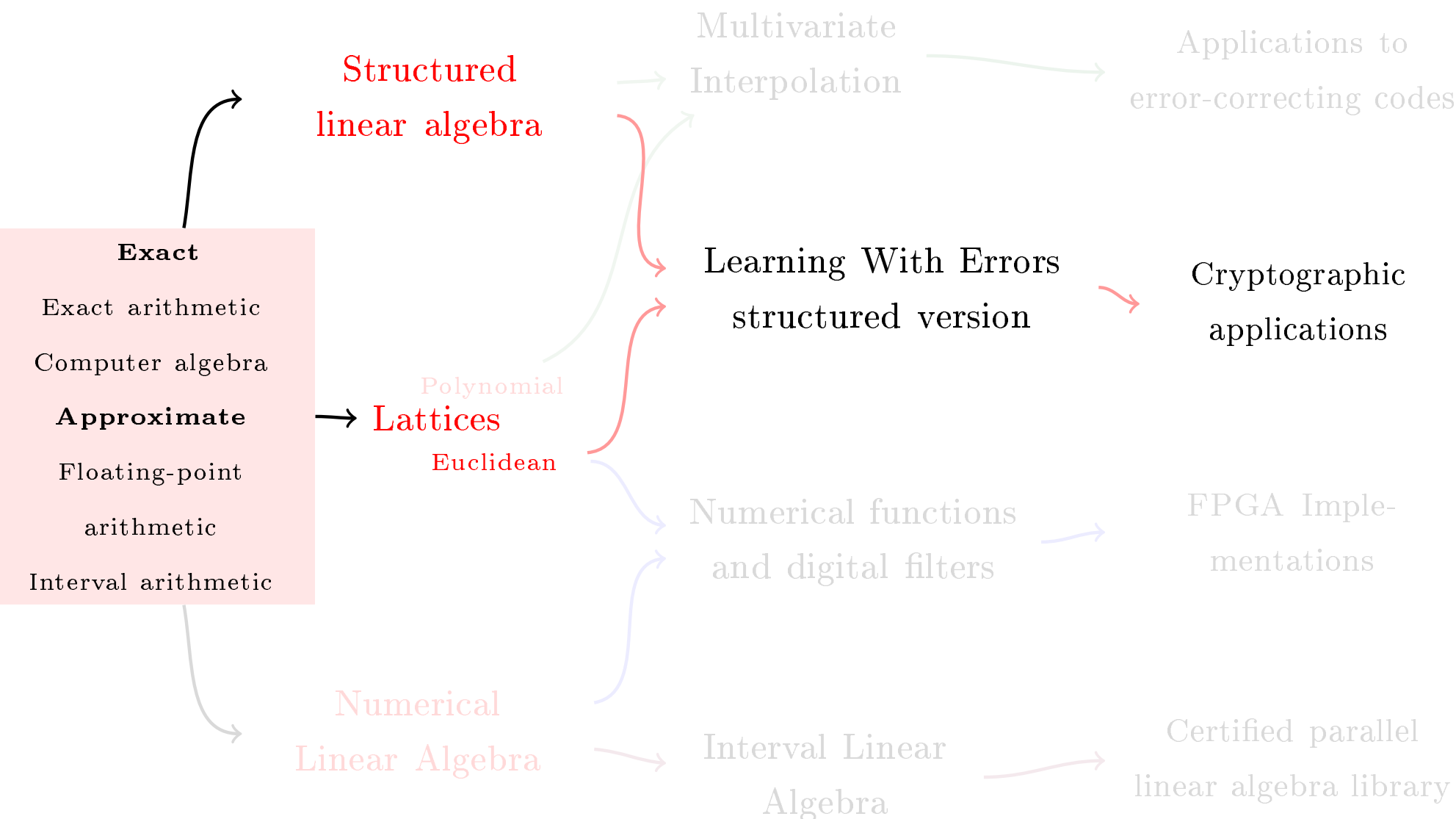
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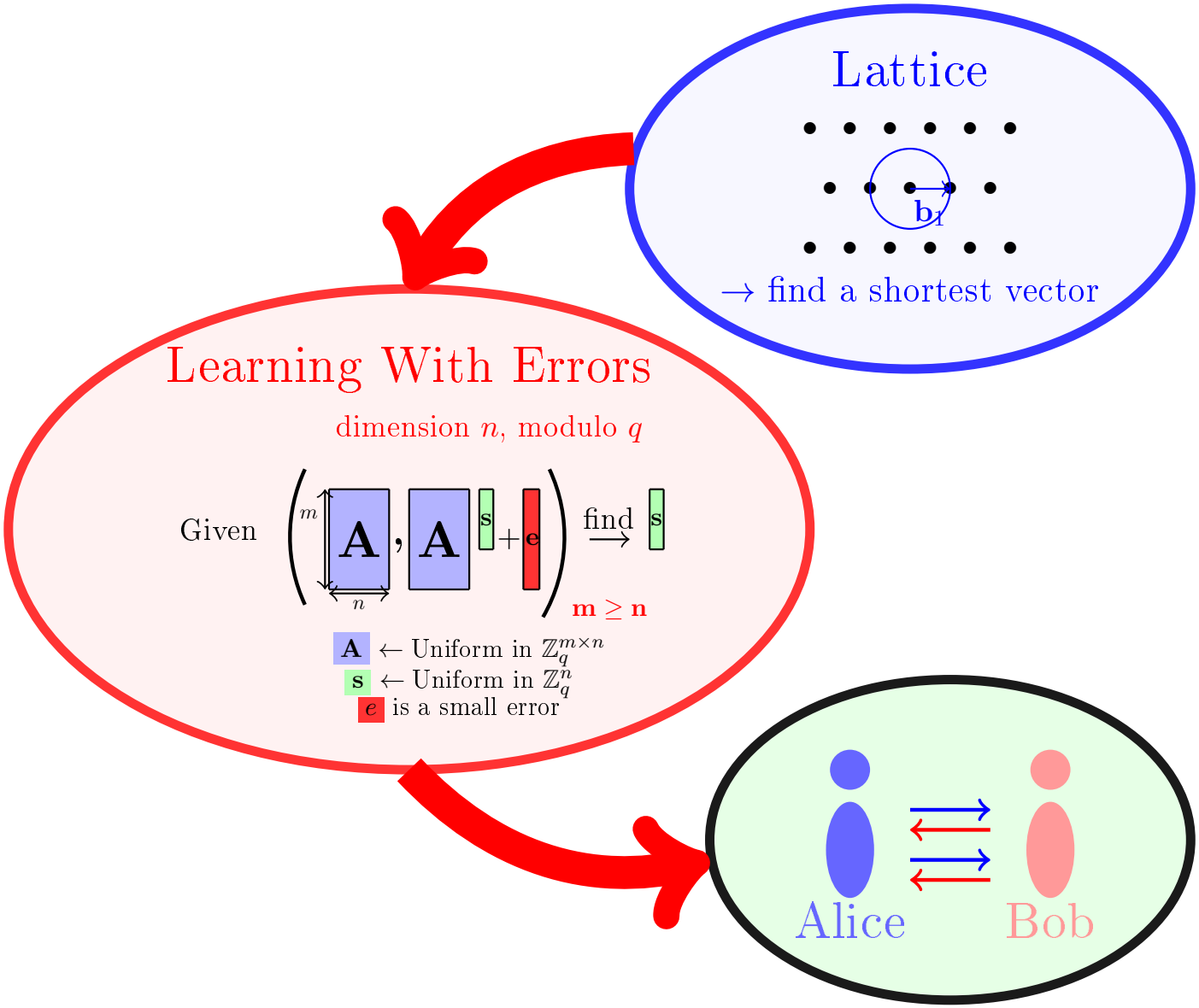
AriC – Lattice-Based Cryptography



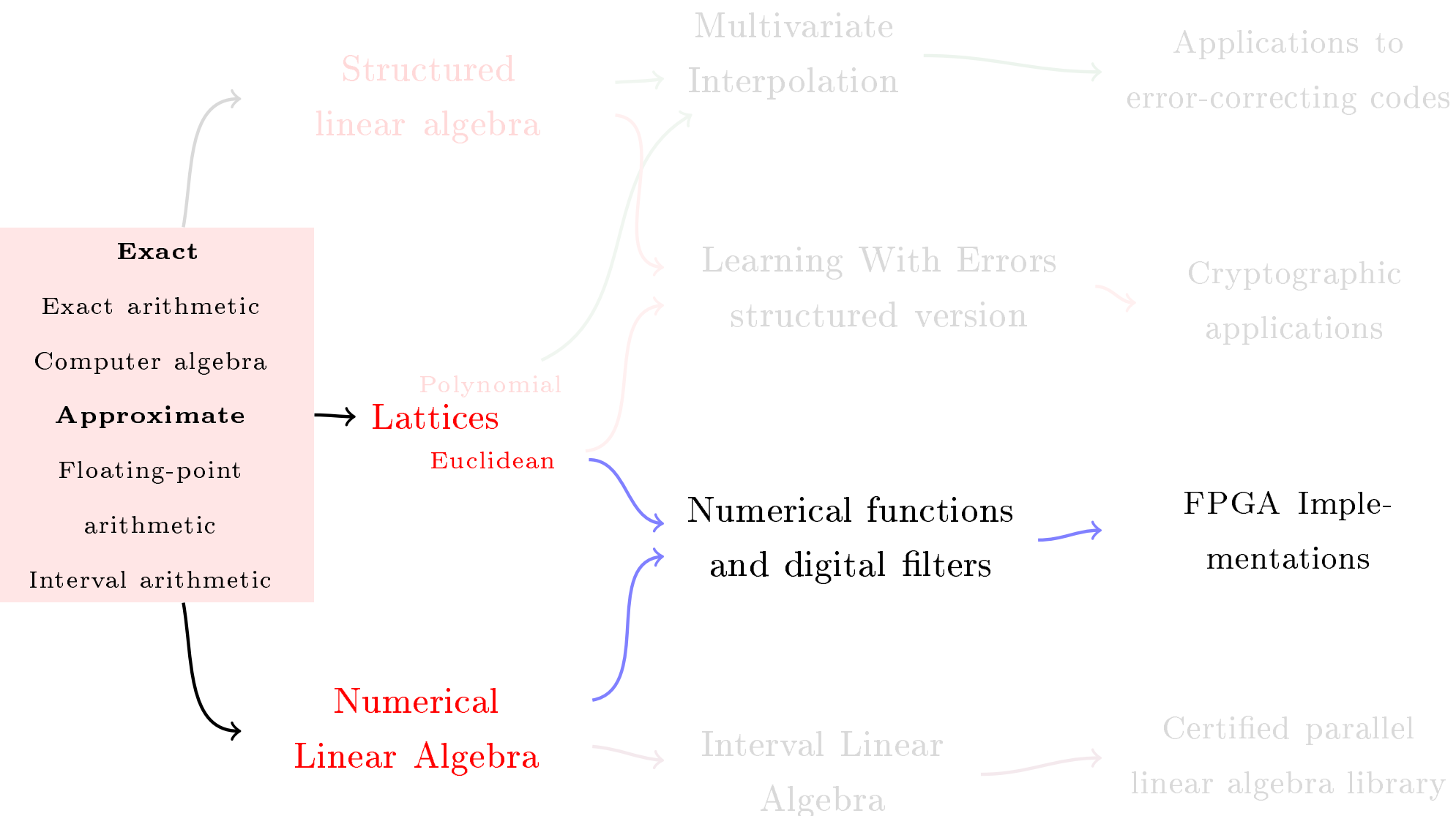
AriC – Lattice-Based Cryptography

- Public Key Encryption
- Identity Based Encryption
- Fully Homomorphic Encryption

- Signature
- Group Signature
- Hash Function

- Cryptographic Multilinear Maps

AriC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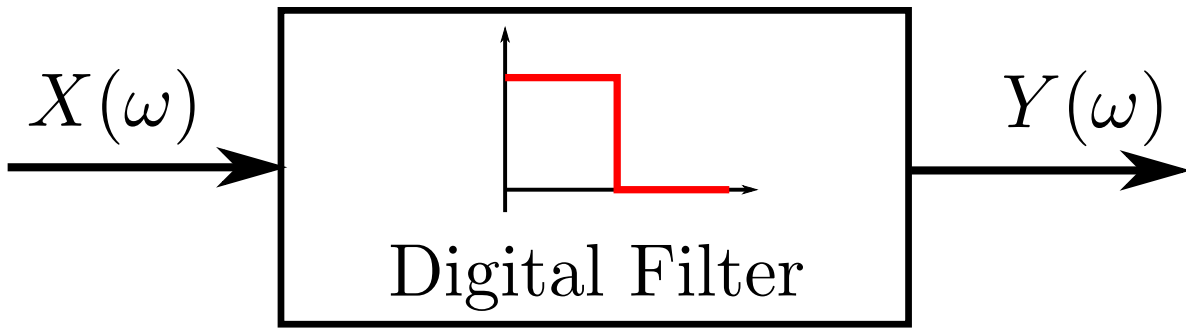
AriC – Digital Filter Design



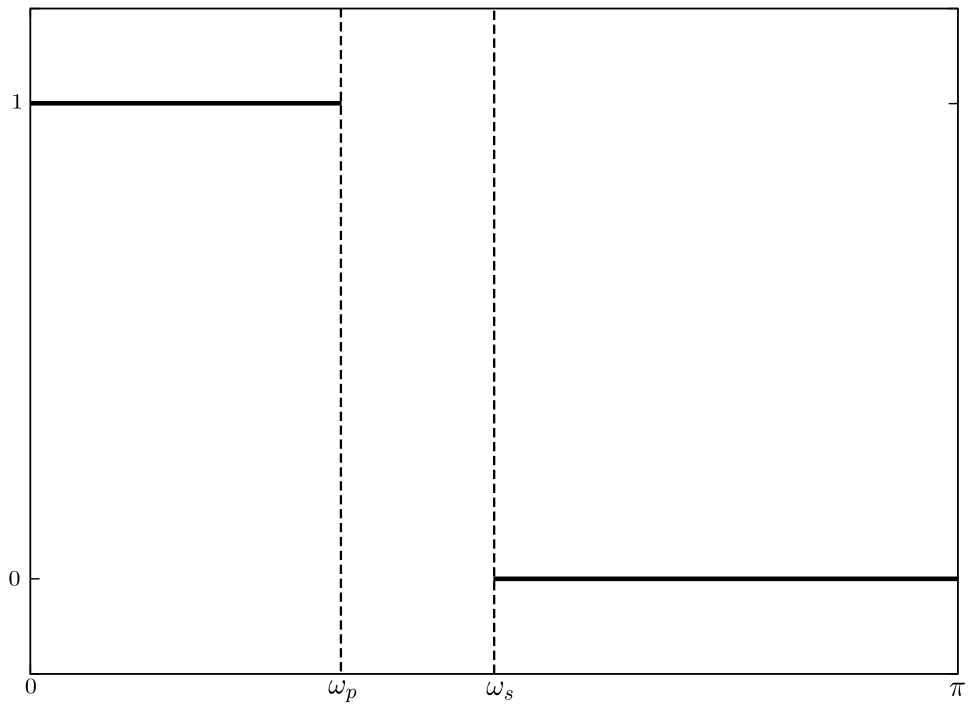
$$Y(\omega) = H_d(\omega)X(\omega), \omega \in [0, \pi]$$

Two types of filters:

- finite impulse response (**FIR**) $\Rightarrow$ $H_d(\omega)$ **polynomial**
- infinite impulse response (**IIR**) $\Rightarrow$ $H_d(\omega)$ **rational function**

AriC – Digital Filter Design

FIR case: $H_d(\omega) = \sum_{k=0}^{L} a_k \cos(\omega k)$



Steps:

1. Optimal filter computation:

$$H_d(\omega) = \sum_{k=0}^{L} a_k \cos(\omega k)$$

Naive rounding:

$$\overline{H}_d(\omega) = \sum_{k=0}^{L} \overline{a}_k \cos(\omega k)$$

2. Coefficient quantization:

$$H_d^*(\omega) = \sum_{k=0}^{L} a_k^* \cos(\omega k)$$

Goal: filter synthesis toolchain for embedded and FPGA targets

AriC – Digital Filter Design

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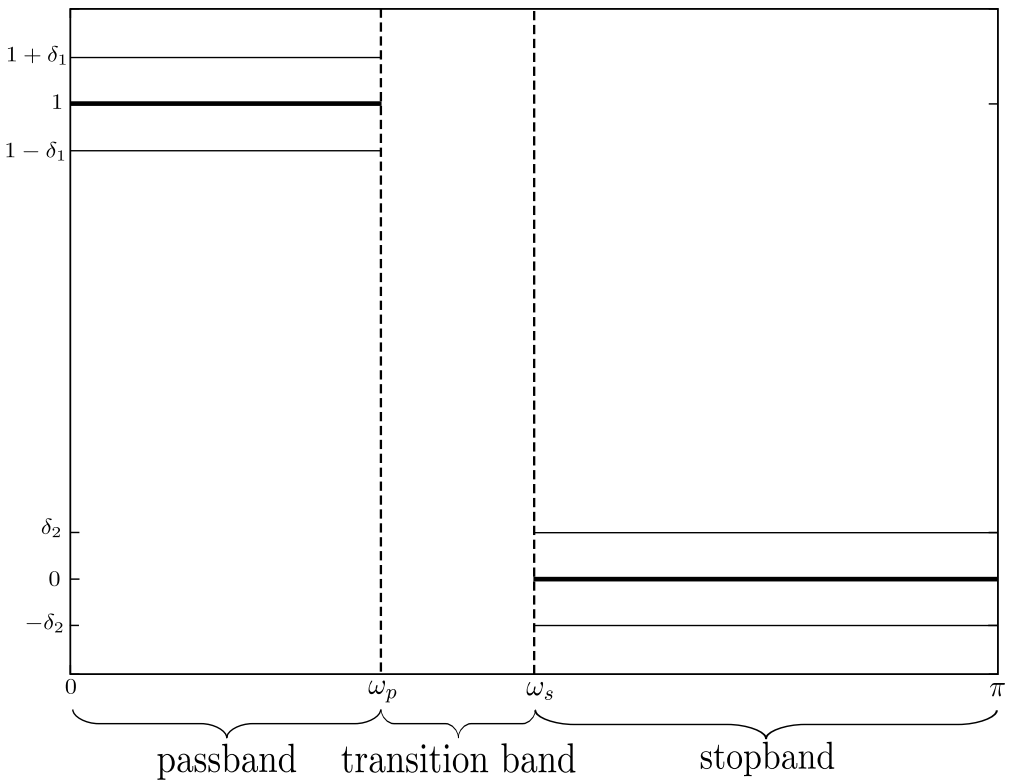

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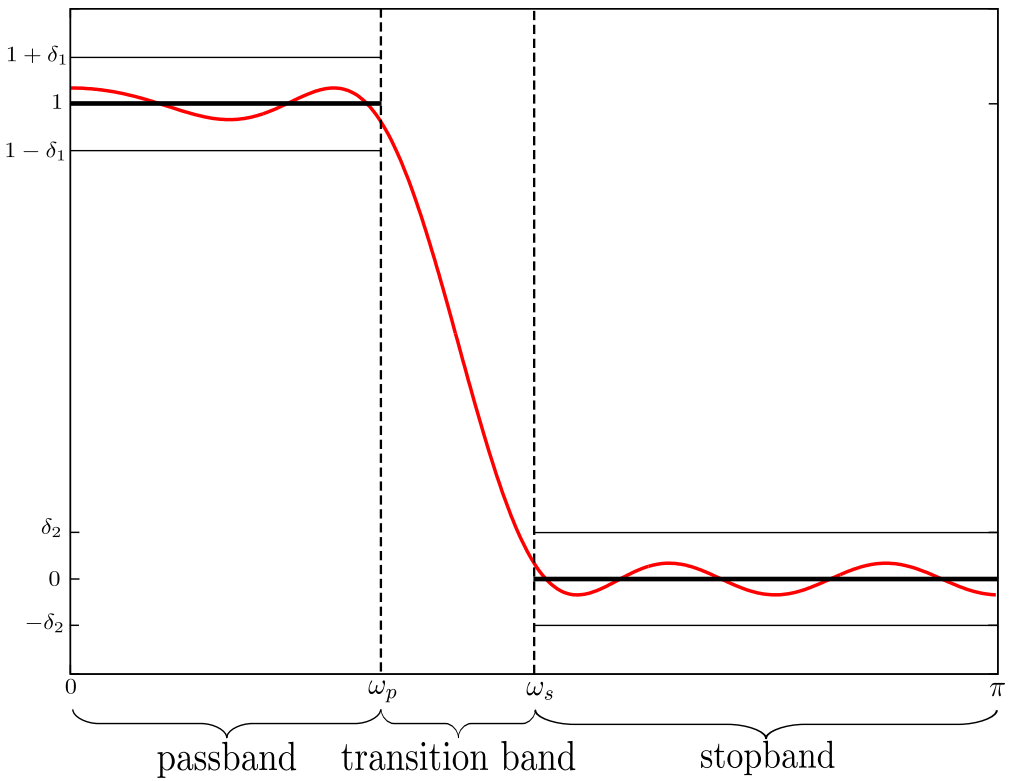

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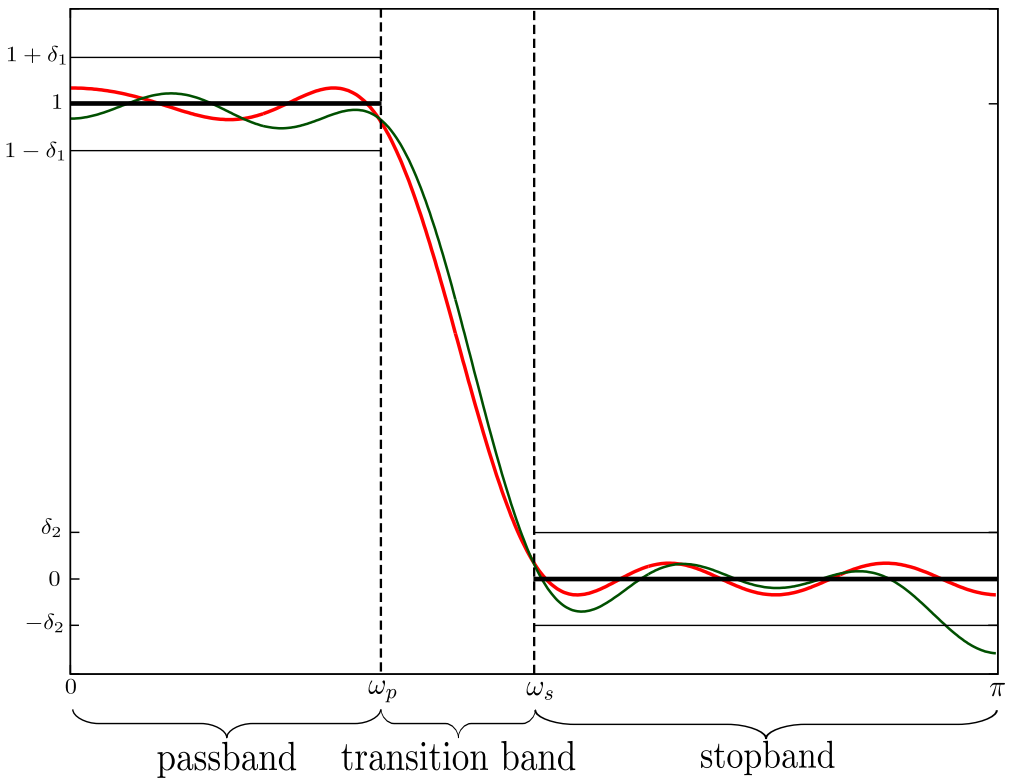

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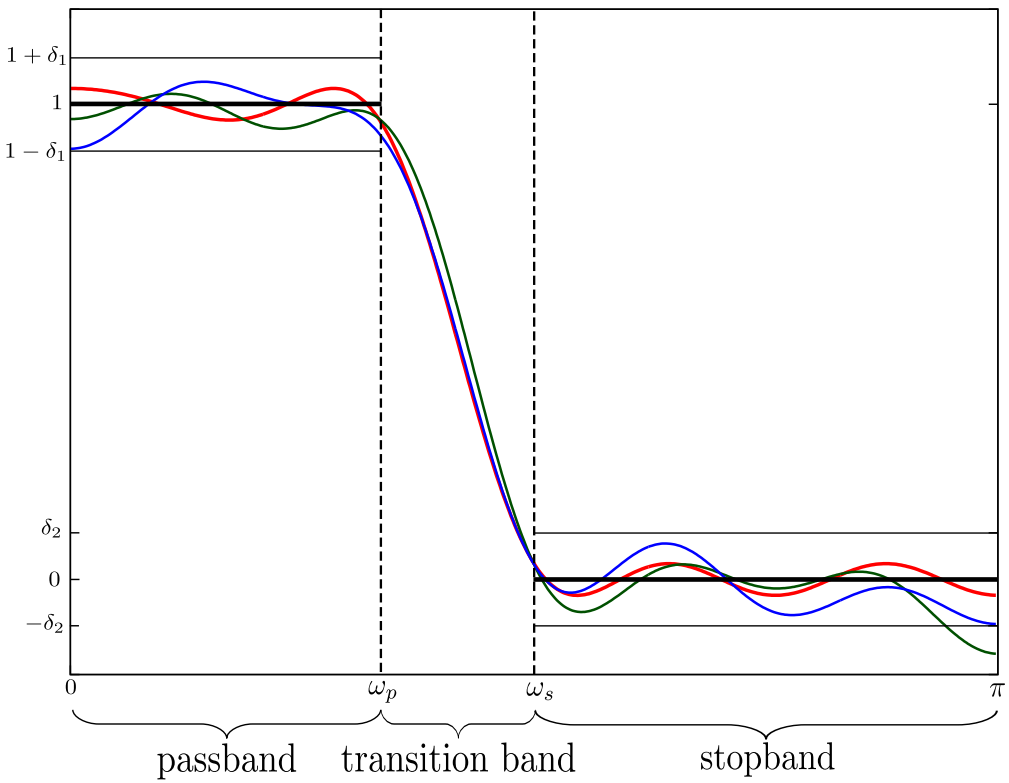

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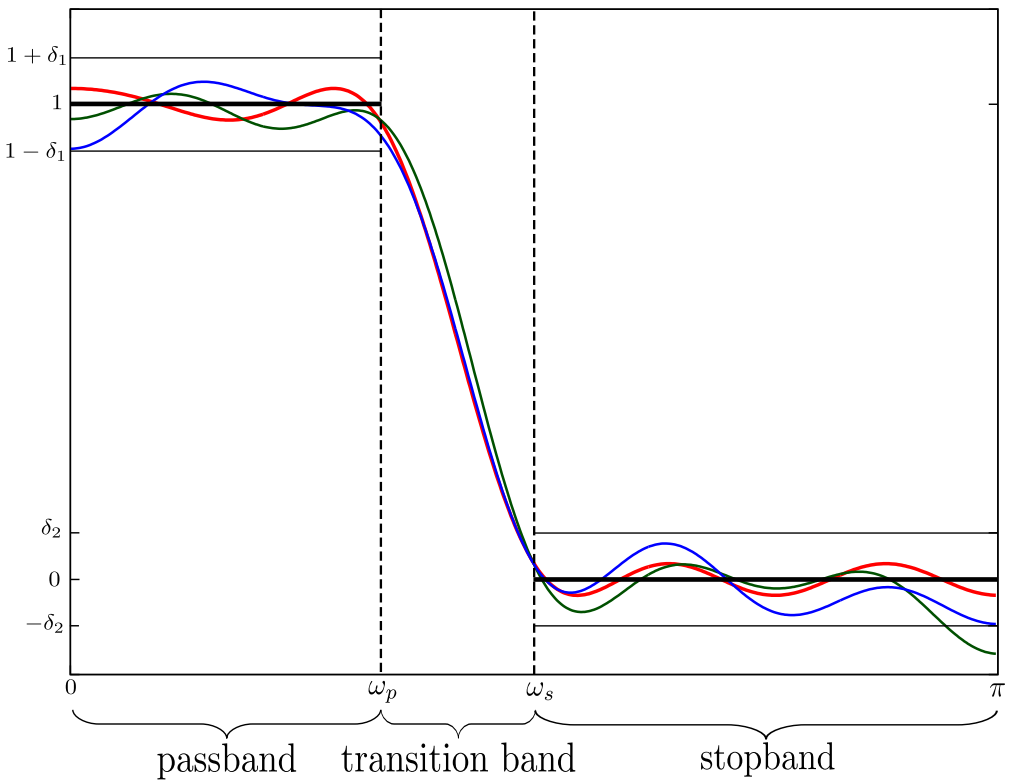

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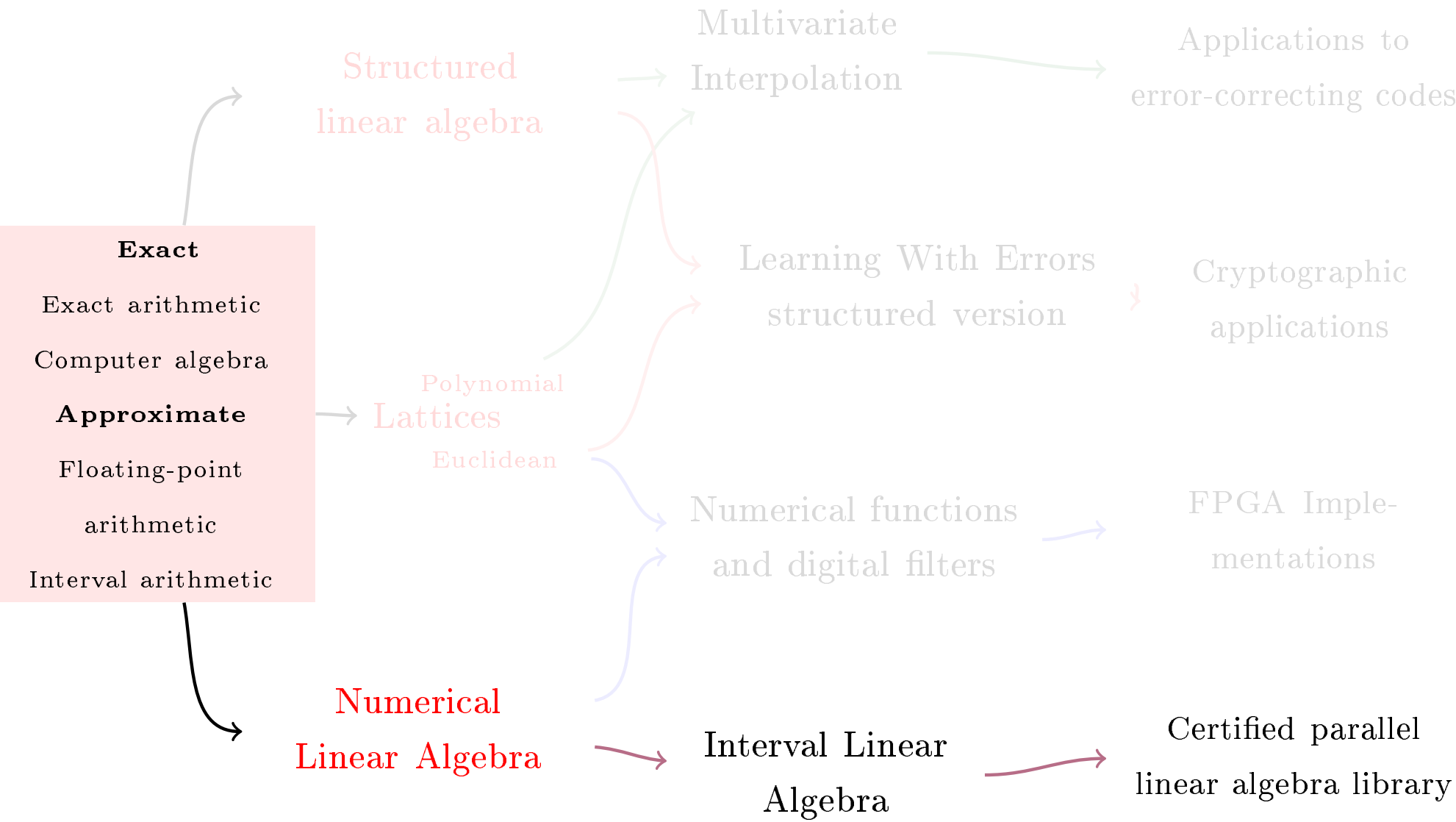
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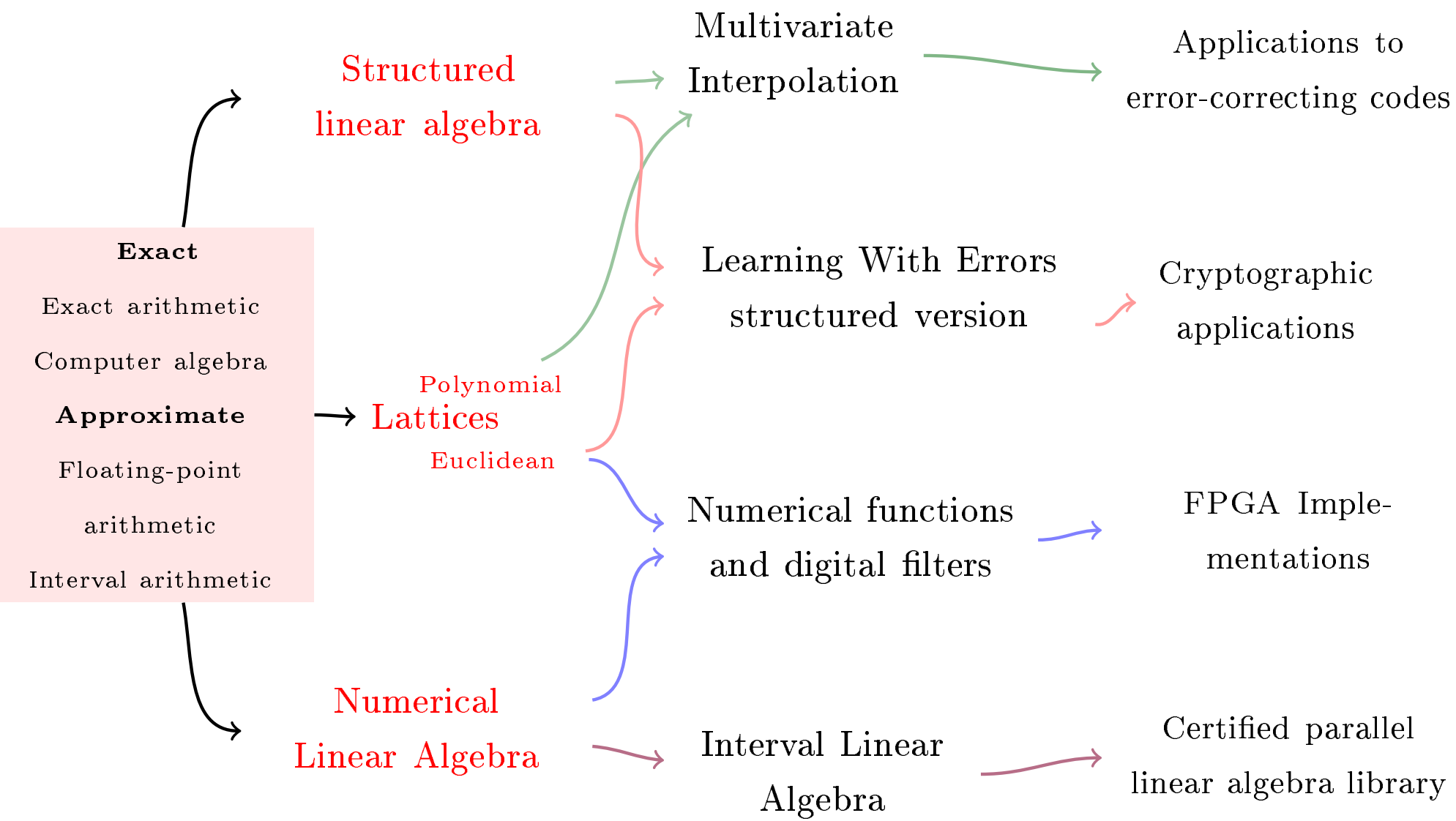
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