moduleqnc
quantum & neuromorphic computing

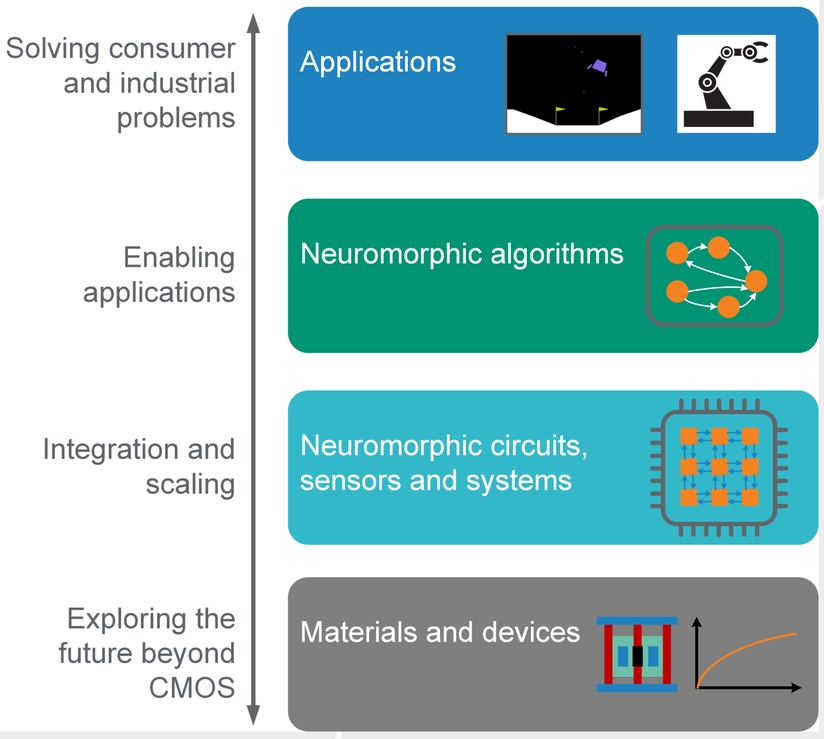
Biologically inspired systems in silicon

Neuromorphic hardware architectures and their design

1 Neuromorphic hardware

Novel neuromorphic devices and hardware architectures inspire the design of processors with previously unreached energy efficiency or latency characteristics.

Within the **FMD** we combine know-how on all abstraction levels of neuromorphic computing to enable the design of **neuromorphic processors.**

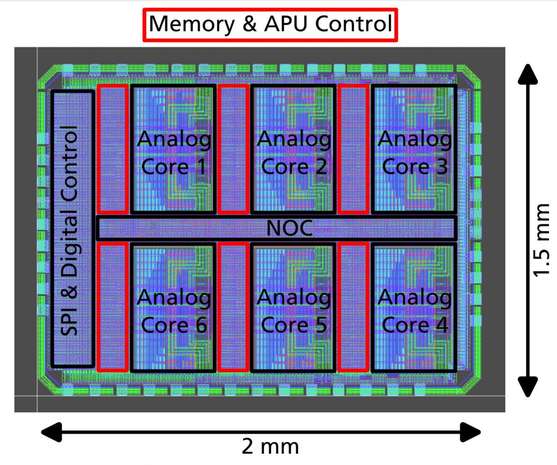


2 Building blocks, architectures and processors

We combine enabling building blocks and neuromorphic devices into architectures to design processors for different algorithms and applications.

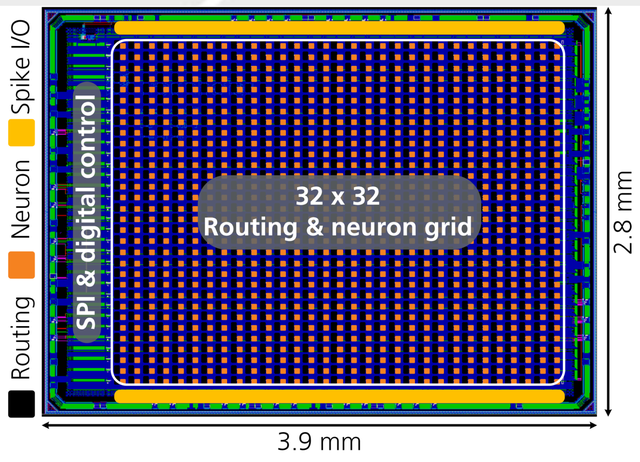
ADELIA

- Packet-switched Network-on-Chip for high flexibility and multi-byte communication
- Analog in-memory computing processing cores for multiply-accumulate (MAC) operations
- Few but complex analog processing unit (APU) cores
- For Artificial Neural Networks (ANNs)
- USP: Ultra-low power



SENNA

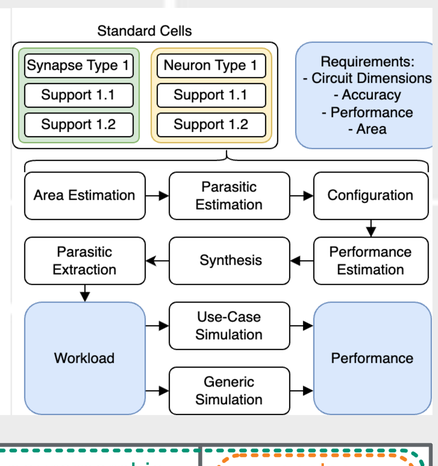
- Circuit-switched Network-on-Chip for ultra-fast single-spike routing
- Leaky-integrate-and-fire (LIF) neuron processing cores
- Many but simple spike processing node (SPN) cores
- For Spiking Neural Networks (SNNs)
- USP: Ultra-low latency



3 Efficient design flows

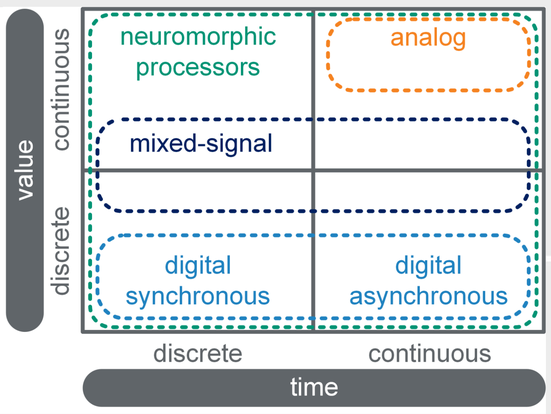
Design automation for large-scale analog design

- Integrates into industry standard design flow and tools for analog/mixed-signal circuits
- Leverages custom analog standard-cells for best performance and flexibility
- Fully automated assembly of module level circuits
- Fully automated simulation and verification
- Enables design automation of **analog computing**



Digital-on-top design flow for mixed-timing and mixed-signal architectures

- Exploit commercial design tools for synchronous digital circuits for place and route and Static Timing Analysis (STA)
- Hide asynchronous timing in custom digital cells
- Hide mixed-signal circuits under digital interfaces
- Enables design automation of **spiking processors**



4 Enabling design

We enable the design of neuromorphic hardware with

- IP and custom designs of enabling building blocks like ADCs,
- our experience in HW/SW co-design and architecture exploration.
- our efficient design flows for analog, mixed-signal and mixed-timing hardware.

5 Enabling applications

Do conventional processors limit your applications?

Get in touch to explore our neuromorphic processors as alternatives.

For inquiries, email us at experts@module-qnc.de

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