anabrid

Revolutionizing Supercomputing

The anabrid REDAC System

REDAC, developed by anabrid for the DLR Quantum Computing Initiative (QCI), offers a groundbreaking platform for academia and industry to explore unconventional computing architectures. This reconfigurable discrete analog computer directly addresses the growing need for energy-efficient high-performance computing. REDAC enables the implementation of physical dynamical systems to solve complex problems through its analog paradigm, seamlessly integrating with existing digital workflows.

Tech Brief REDAC

Architecture and Specifications	A REDAC as shown above contains 6 modular clusters, with a total of • 432 multipliers, 864 integrators • 1.728 summation lanes, 124.416 switching elements and 3.456 scaling elements • Remote access and a reconfigurable architecture accessible via a user-friendly software stack • Modular structure enables cascading multiple REDACs
Topology	• Local all-to-all coupling implemented • Option for customized topologies via topology modules • Crossbar-based routing supports scalable interconnects • Configured via software-stack running on digital computer (place-and-route)
Bandwidth and Communication	• Analog signal routing ensures high parallel bandwidth • Hybrid system with digital interfaces for programming & control (e.g., Python, Jupyter) • Supports batch operations, real-time feedback, external synchronization • Offers analog I/O interface
Automated Calibration Process	• Offset and gain error compensation in hardware addresses temperature drift and component heterogeneity • Firmware-based error correction • Temperature stabilization strategies • Empirical accuracy: <1% deviation compared to digital PDE solvers

Federal Ministry for Economic Affairs and Climate Action

A project of QCi DLR Quantum Computing Initiative

We enable Quantum - qci.dlr.de

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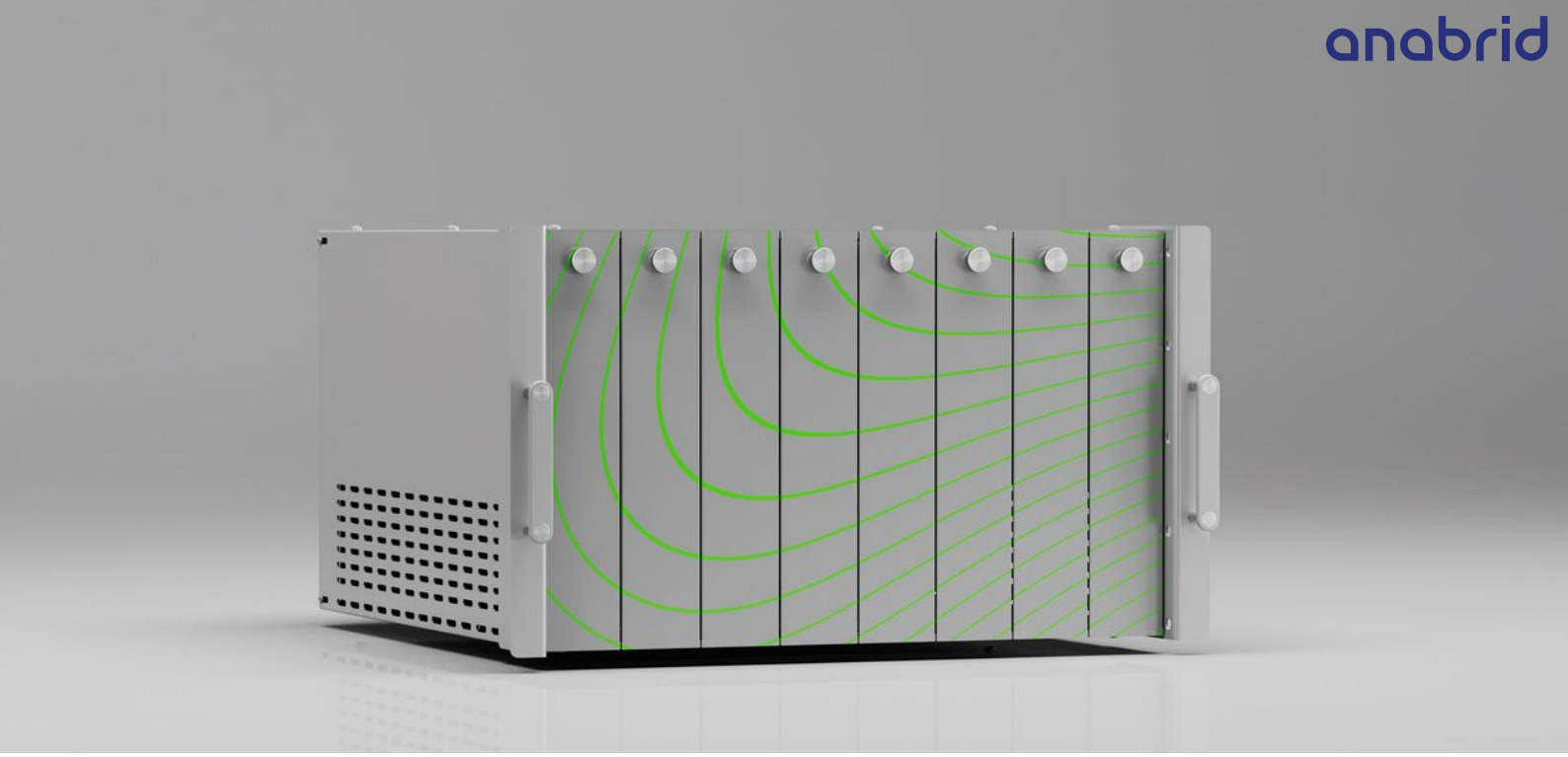

Main Focus	Energy and Efficiency	USPs
• Solving complex ordinary and partial differential equations (ODEs & PDEs) • Hybrid computation platform for research & industry • Test-bed for unconventional computing • Solving optimization problems	• REDAC power consumption 10-20 times less than modern digital computers • Significantly faster for large problem sets • Solve complex problems with great accuracy in real-time • Analog computation enables real-time solutions difficult to achieve with digital computers	• REDAC combines analog computing power with digital control • It enables real-time solutions for complex equations • Up to thousands of computing elements work in parallel in a modular structure • Better energy efficiency than digital computers • Significantly faster for a large set of problems • Seamless integration into digital workflows (Python, Jupyter, API) • Excellent for optimization, simulation & scientific computations

The REDAC System

Exemplary applications are solving differential equations (PDEs, ODEs), the heat conduction equation, hydrodynamic models, real-time optimization problems, like energy minimization and Monte-Carlo methods, hybrid analog-digital/quantum computations, i.e., in symbiosis with digital or quantum algorithms and parallelized numerical simulations.

REDAC is built on a groundbreaking analog dataflow architecture that delivers unparalleled performance and energy-efficiency. REDAC is available as an on-premise, data- center-grade solution or as a cloud computing service hosted by anabrid or its certified OEM partners, ensuring flexibility and scalability for diverse user needs.

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