Entwining physics and electronics, I explore and design unconventional computational architectures that can transcend computing to an open, interactive and evolving system that can solve a diverse range of problems.

Research outputs

Training energy-based single-layer Hopfield and oscillatory networks with unsupervised and supervised algorithms for image classification

Non-volatile resistive switching mechanism in single-layer MoS2 memristors: insights from ab initio modelling of Au and MoS2 interfaces

Two-Layered Oscillatory Neural Networks with Analog Feedforward Majority Gate for Image Edge Detection Application

Supported Pt Nanoclusters on Single-Layer MoS2 for the Detection of Cortisol: From Atomistic Scale to Device Modeling

Oscillatory neural network learning for pattern recognition: an on-chip learning perspective and implementation

SIFT-ONN: SIFT Feature Detection Algorithm Employing ONNs for Edge Detection

Building Oscillatory Neural Networks: AI Applications and Physical Design Challenges

Simulation and implementation of two-layer oscillatory neural networks for image edge detection: bidirectional and feedforward architectures

A Mixed-Signal Oscillatory Neural Network for Scalable Analog Computations in Phase Domain

Energy-Performance Assessment of Oscillatory Neural Networks Based on VO 2 Devices for Future Edge AI Computing

Oscillatory Neural Networks Applications for Edge Computing
Roadmap for Unconventional Computing with Nanotechnology

Enabling Multi-programming Mechanism for Quantum Computing in the NISQ Era

Oscillatory Neural Network for Edge Computing: A Mobile Robot Obstacle Avoidance Application

Role of ambient temperature in modulation of behavior of vanadium dioxide volatile memristors and oscillators for neuromorphic applications

Réseaux de neurones oscillants pour des calculs économies en énergie
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TCAD Electrothermal Simulations of Beyond-CMOS VO2 temperature-sensing neuron devices
Carapezzi, S. & Todri-Sanial, A., 1 Nov 2022

Capillary-force-driven self-assembly of carbon nanotubes: from ab initio calculations to modeling of self-assembly

Oscillatory Neural Networks for Obstacle Avoidance on Mobile Surveillance Robot E4

On-Chip Learning with a 15-neuron Digital Oscillatory Neural Network Implemented on ZYNQ Processor

Solving the Travelling Salesman Problem in Continuous Phase Domain with Neuromorphic Oscillatory Neural Networks
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Ab Initio Computer Simulations on Interfacial Properties of Single-Layer MoS2 and Au Contacts for Two-Dimensional Nanodevices

Method for recognizing a pattern in an image and associated devices
Electro-thermal simulations of beyond-CMOS vanadium dioxide devices and oscillators

Simulation Toolchain for Neuromorphic Oscillatory Neural Networks Based on Beyond-CMOS Vanadium Dioxide Devices

Multi-programming Cross Platform Benchmarking for Quantum Computing Hardware

How Frequency Injection Locking Can Train Oscillatory Neural Networks to Compute in Phase

Analyzing Strategies for Dynamical Decoupling Insertion on IBM Quantum Computer


Carbon Nanotube SRAM in 5-nm Technology Node Design, Optimization, and Performance Evaluation - Part II: CNT Interconnect Optimization

Effects of Dynamical Decoupling and Pulse-level Optimizations on IBM Quantum Computers

Oscillatory Neural Network as Hetero-Associative Memory for Image Edge Detection

Enabling multi-programming mechanism for quantum computing in the NISQ era

Assessing doping strategies for monolayer MoS$_2$ towards non-enzymatic detection of cortisol: a first-principles study

Introduction to the Special Issue on Monolithic 3D: Technology, Design and Computing Systems Applications Perspectives

How Parallel Circuit Execution Can Be Useful for NISQ Computing?
Advanced Design Methods From Materials and Devices to Circuits for Brain-Inspired Oscillatory Neural Networks for Edge Computing

How Parallel Circuit Execution Can Be Useful for NISQ Computing?

Graphene and Carbon Nanotubes for Electronics Nanopackaging

Mapping Hebbian Learning Rules to Coupling Resistances for Oscillatory Neural Networks

Insights Into the Dynamics of Coupled VO2 Oscillators for ONNs

Digital Implementation of Oscillatory Neural Network for Image Recognition Applications

Exploring 1D and 2D Nanomaterials for Health Monitoring Wearable Devices

Analyzing crosstalk error in the NISQ era

Oscillatory Neural Networks for Edge AI Computing

Multi-Scale Modeling and Simulation Flow for Oscillatory Neural Networks for Edge Computing

Frequency Injection Locking-Controlled Oscillations for Synchronized Operations in VO2 Crossbar Devices

Analyzing crosstalk error in the NISQ era

qprof: a gprof-inspired quantum profiler
Oscillatory Neural Networks Using VO2 Based Phase Encoded Logic

Dedicated Wearable Sensitive Strain Sensor, Based on Carbon Nanotubes, for Monitoring the Rat Respiration Rate †

A Hardware-Aware Heuristic for the Qubit Mapping Problem in the NISQ Era

1D Nanomaterial-Based Highly Stretchable Strain Sensors for Human Movement Monitoring and Human–Robotic Interactive Systems

Electrochemical Glucose Sensor using Single-Wall Carbon Nanotube Field Effect Transistor

Stretchable Strain Sensors for Human Movement Monitoring

Review—Energy Autonomous Wearable Sensors for Smart Healthcare: A Review

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Power-Supply Noise Analysis for Monolithic 3D ICs Using Electrical and Thermal Co-Simulation

SmartVista: Smart autonomous multi modal sensors for vital signs monitoring

Atomistic- to Circuit-Level Modeling of Doped SWCNT for On-Chip Interconnects

A high-reliability and low-power computing-in-memory implementation within STT-MRAM.

Variability study of MWCNT local interconnects considering defects and contact resistances-Part I: Pristine MWCNT

Variability study of MWCNT local interconnects considering defects and contact resistances-Part II: Impact of charge transfer doping

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Power Supply Noise Aware Task Scheduling on Homogeneous 3D MPSoCs Considering the Thermal Constraint

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Synchronised 4-phase resonant power clock supply for energy efficient adiabatic logic

Atoms-to-circuits simulation investigation of CNT interconnects for next generation CMOS technology

The impact of vacancy defects on CNT interconnects: From statistical atomistic study to circuit simulations

Electrical performance of carbon-based power distribution networks with thermal effects

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Design methodology for 3D power delivery networks

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A body-biasing of readout circuit for STT-RAM with improved thermal reliability

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Enhancement of the ATLAS trigger system with a hardware tracker finder FTK

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Power supply noise aware workload assignment for multi-core systems

Analysis and optimization of power-gated ICs with multiple power gating configurations

Electromigration and voltage drop aware power grid optimization for power gated ICs

**Press/Media**

*First Eindhoven-Taiwan Summer School on semiconductors and photonics to take place at TU/e*
Martijn J.R. Heck, Lin-Lin Chen & Aida Todri-Sanial
22/08/23
1 item of Media coverage