


# Jan Esquível Marxen


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## Computational Researcher - Integrated Computing Architectures

Passionate researcher with 3+ years experience in applied mathematics, machine learning, and **high-performance computing** - ready to contribute to **neuromorphic** and **novel computing paradigms**.

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# Academic Foundation & Research Journey

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## Bachelor in Applied Mathematics (2018-2021) - ISEL Lisbon & INSA Toulouse

- **Francisco da Fonseca Benevides Medal** for exceptional performance in physics (19.5/20)
- Thesis on **bio-inspired optimization algorithms** for scaffold design - bridging biology and computation
- Strong foundation in **mathematical modeling**, numerical analysis, and computational physics
- Specialized in **advanced numerical methods** and algorithm development

## Bio-Engineering Research Publications (2021)

- Published research in **Institute of Physics** (American Journal) - peer-reviewed scientific publication
- Presented at **international conferences** on computational biology and biomaterials
- Developed algorithms based on **Krylov subspace methods** - advanced mathematical techniques
- Experience with **nature-inspired computing** - relevant to neuromorphic systems



# Research & Professional Experience

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## European Central Bank (2022-2024) - HPC Research & Development

- Financial Stability Analyst & Research Assistant
- Developed **distributed HPC models** and parallel numerical solvers for large-scale simulations
- Architected **high-performance computing infrastructure** and automated workflows
- Processed **massive datasets** using advanced mathematical models for systemic risk analysis
- Collaborated with economists and PhDs in an **interdisciplinary research environment**

## Bio-Engineering Researcher (2021) - Bio-Inspired Computing

- €250,000 funded project on **bio-scaffold optimization** using nature-inspired algorithms
- Published in **Institute of Physics** (American Journal) - peer-reviewed research
- Developed **topology optimization algorithms** inspired by biological systems
- Applied **Krylov subspace methods** for complex mathematical modeling

## Data Scientist - SIBS/Closer (2022) - Real-Time Computing

- Built **real-time ML pipelines** for fraud detection with microsecond latency requirements
- Expertise in distributed computing frameworks (PySpark, Kafka, Dask) for **streaming data**
- Developed **adaptive algorithms** for model monitoring and drift detection

# Technical Expertise

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## Programming Languages

- **C/C++** (systems programming, scientific simulations, low-level hardware interfaces)
- **Assembly** (hardware modeling/simulation, instruction sets, neuromorphic architectures)
- **Python** (ML/data science, research prototyping)
- Julia, MATLAB (scientific computing, numerical methods)

## Parallel & Novel Computing

- **CUDA & CuDNN** (GPU acceleration)
- **MPI & OpenMP** (distributed computing)
- **SYCL** for heterogeneous computing (GPU/FPGA)
- Multi-node cluster deployment & **novel accelerator integration**

## AI & Neuromorphic Computing

- **PyTorch** & TensorFlow (deep learning frameworks)
- Distributed training optimization, **performance engineering**
- Neural networks, transformers, **spike-based models**
- Experience with **bio-inspired algorithms** and optimization

## Research Infrastructure

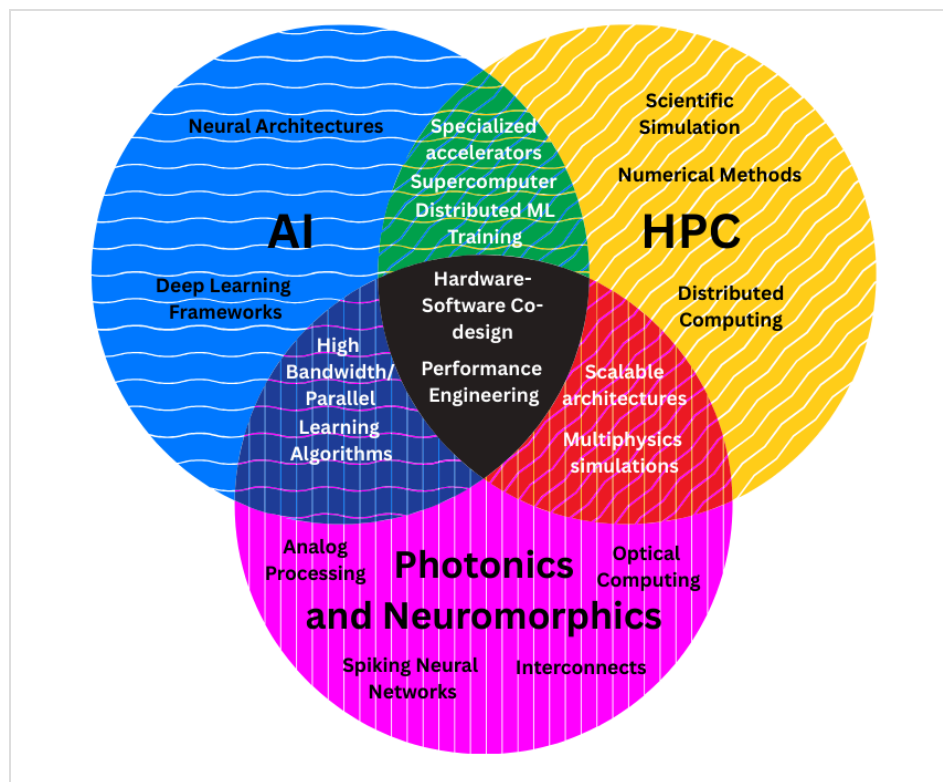
- **HPC schedulers** (Slurm, OAR) - supercomputer environments
- **Scientific computing clusters** & research infrastructure
- **Hardware simulation** and modeling environments
- **Collaborative research** tools and version control



# Motivation

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- Pioneer **integrated computing architectures** that bridge classical and novel computing paradigms
- Build the software stack for **neuromorphic and/or photonic computing** systems
- Contribute to **sustainable computing** through energy-efficient architectures
- Work hands-on with **novel hardware prototypes** and emerging computing architectures



# How I Can Contribute to PGI-4

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- Deep experience with **HPC systems** and supercomputer architectures
- Proven track record in **performance engineering** and optimization
- Strong foundation in **mathematical modeling** and numerical methods
- Hands-on experience with **heterogeneous computing** environments
- Collaborative **interdisciplinary research** experience across physics, mathematics, and CS
- Experience building **research prototypes** from concept to implementation


# Why PGI-4 at Forschungszentrum Jülich

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- Working with **world-class researchers in hardware** development and design
- Learn more about **hardware modeling** and novel computing architectures
- **Co-design algorithms** by collaborating with hardware people

**Ready to Contribute to PGI-4's Vision of Next-Generation Computing**

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