Nassim El Massaudi

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R&D Engineer — Simulation, AI & Software Architecture

Engineer combining robust software architecture, differentiable physics simulation (JAX/Diffrax), and applied AI. Focused on dynamics, guidance & control, and high-performance simulation systems for aerospace applications.

Education

M.Sc. in Computer Science — Artificial Intelligence **Sep. 2020 – Dec. 2023**
Université Laval *Québec City, Canada*

Graduate-level Coursework (BCI Exchange & Independent Student) **2022 – 2024**
Université de Montréal / Mila *Montréal, Canada*

Engineering Degree — Computer Science & Information Security **Sep. 2019 – Jun. 2022**
ECE Paris (École Centrale d'Électronique) *Paris, France*

Technical Skills

Simulation & Orbital/Spaceflight Dynamics: **Flight Dynamics** (Keplerian orbits, J2 perturbations, maneuvers), **Differentiable Physics** (JAX, Diffrax, RK4/Dopri5/Tsit5), **Basilisk** (architecture & scripting), **Reference Frames** (ECI ↔ RIC/LVLH).

Software & Cloud: **Python** (expert), C/C++, SQL, Git, Docker, Kubernetes, CI/CD, **Azure** (AI services, SQL, serverless), GCP, AWS, Terraform.

AI / Machine Learning: **Deep Learning** (PyTorch, JAX/Flax, TensorFlow), **Reinforcement Learning** (PPO, SAC, model-based), **GenAI** (RAG, GANs/CTGAN, LLMs), **Optimization** (gradient-based, Optuna).

Engineering & Research Projects (Aerospace & AI)

Orbitrax (Creator & Lead Developer) — Differentiable Orbital Dynamics Engine
Designed and implemented (from scratch) a high-performance orbital simulation environment in JAX, aimed at coupling spaceflight dynamics with RL and gradient-based control.

Key achievements:

- ✔ Implemented perturbed equations of motion (J2) and continuous thrust with variable mass handling.
- ✔ Integrated numerically stable ODE solving via Diffrax (e.g., Tsit5 wrappers / solver tuning) for simulation robustness.
- ✔ Implemented frame transformations (ECI to RIC/LVLH) for relative motion observation (e.g., proximity operations).

Technologies: Python, JAX, Diffrax, Astrodynamics, Linear Algebra, Runge–Kutta Methods.

Abenaki Community Project (Tech Lead): Designed and deployed end-to-end backend infrastructure (FastAPI/PostgreSQL) for natural resource management. Focus on robust and secure architecture.

Synthetic Data GenAI (RAMQ): Built generative models (GANs / copulas) to simulate realistic patient data while preserving privacy and statistical structure.

Professional Experience

AI Engineer / Consultant — Backend & Data **Sep. 2021 – Present**
AI Global Pros *Montréal, Canada*

- **Critical Decision Support System (Heavy-Duty Vehicle Sector)**
  Designed backend architecture (Python/Quart) for an intelligent parts recommendation system; orchestrated asynchronous microservices and complex SQL integration.
  Key achievements:
  - ✔ Robust architecture reducing maintenance turnaround time by 12%.
  - ✔ Reduced expert workload by 70% through automation and guided workflows.

  Technologies: Azure, Python (Quart, AsyncIO), SQL, Microservices Architecture.

- **Forecasting & Optimization Pipeline (Automotive Sector)**
  Deployed an MLOps infrastructure on Kubernetes (GCP) to automate ~2M monthly forecasts; integrated CI/CD and monitoring.
  Key achievements:
  - ✔ Reduced forecasting error by 34% via hyperparameter optimization and model selection.
  - ✔ Replaced a critical manual process with full automation.

  Technologies: Python, GCP, Kubernetes, Docker, Time Series Forecasting.

AI Intern **May 2023 – Dec. 2023**
RAMQ — Régie de l'Assurance Maladie du Québec *Québec City, Canada*

- **R&D — GenAI and Privacy**
  Developed models (CTGAN, copulas) for synthetic data generation; conducted rigorous statistical validation of generated distributions vs. real data.
  Key achievements:
  - ✔ Validated proof of concept for secure synthetic data use in controlled environments.

  Technologies: Python, PyTorch, CTGAN, Statistics, Privacy.