Gabriele Immordino, PhD

Aerospace Engineer & Machine Learning Researcher

Core Focus

- Machine Learning for Physical Systems
- Geometric Deep Learning on Simulation Grids
- Large Language Models for Regulatory Safety Assessments
- Reinforcement Learning for Control

Impact of My Work

Accelerating engineering workflows using machine learning and simulation data

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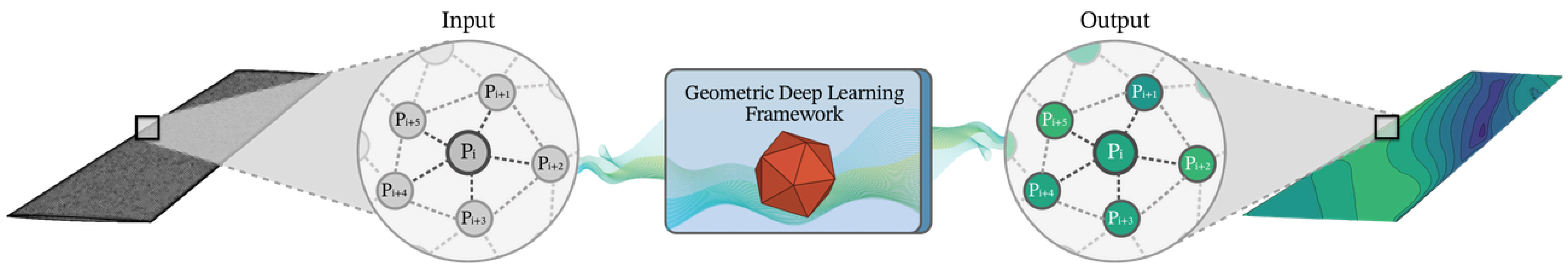
EXPERTISE

Scientific Machine Learning

- Reduced order models for physics systems
- Surrogate modelling of simulations
- Uncertainty aware models

Geometric Deep Learning

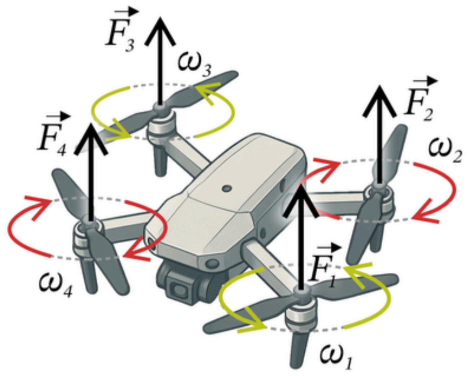
- Graph neural networks on unstructured grids
- Spatio temporal models for 3D fields



Geometric deep learning framework for aerodynamics simulations

Aerospace Simulation

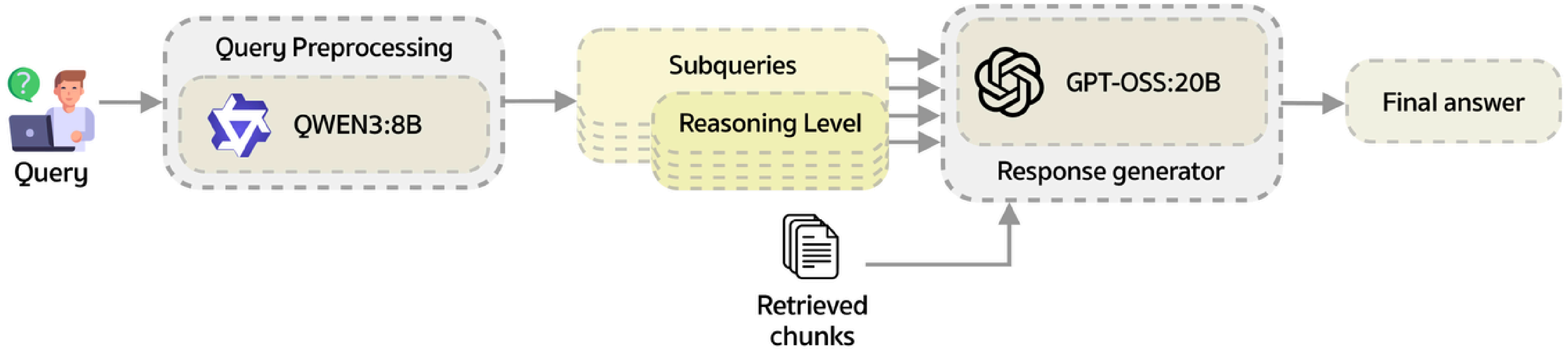
- Large scale simulation data pipelines
- Aerodynamic modelling
- Aeroelastic systems



Drone Digital Twin

AI Systems Engineering

- LLM based knowledge systems
- Large scale ML workflows
- Reinforcement learning



RAG+LLM Assistant for regulatory compliance

PROJECT 1: PHD RESEARCH

DATA DRIVEN MODELLING OF NONLINEAR AERODYNAMICS

Goal

Reduce the computational cost of complex aerodynamic simulations.

Approach

Train machine learning models on CFD data to predict aerodynamic flowfields.

Methods used

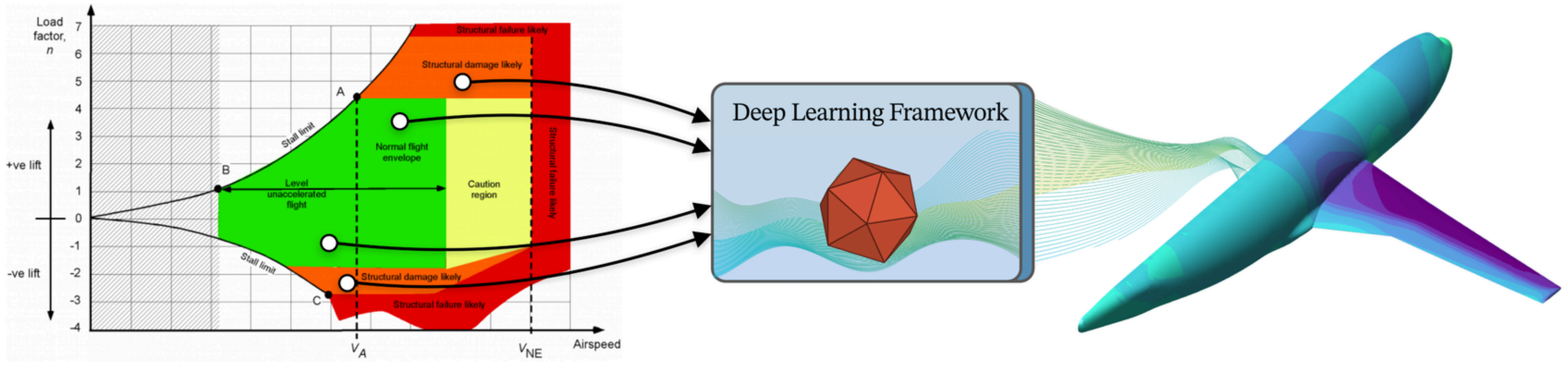
- Graph Autoencoders
- Spatio temporal neural networks
- Bayesian neural networks
- Multi fidelity learning

Outcome

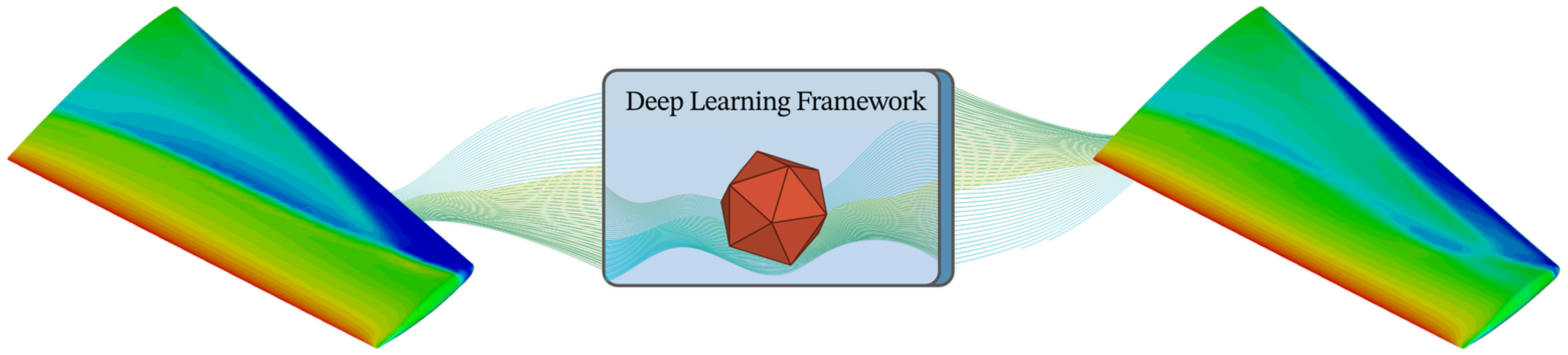
- Accurate prediction of aerodynamic flowfields
- Up to 10^5x speedup compared to high fidelity simulations

Industrial Applications

- Rapid design space exploration



- Early-stage shape optimization



PROJECT 2: LARGE LANGUAGE MODEL

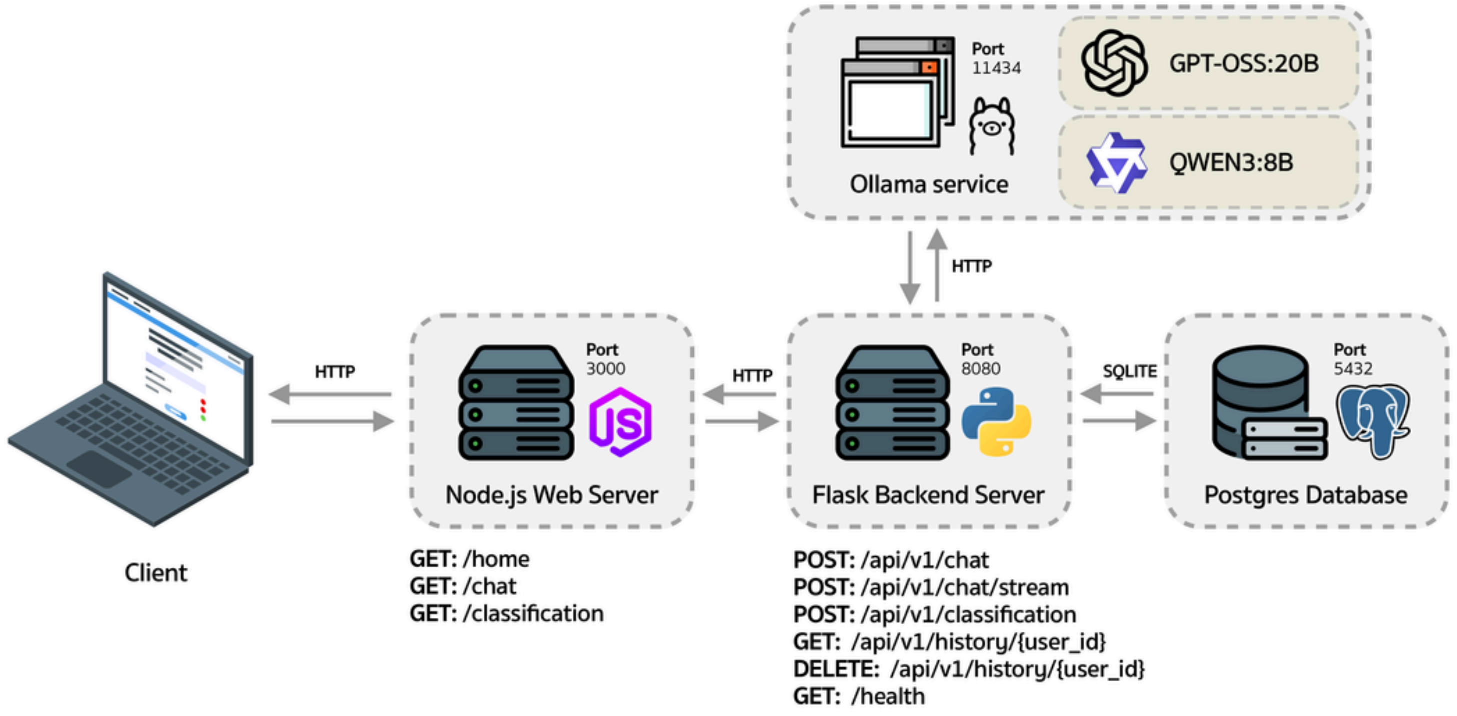
AI ASSISTANT FOR AVIATION SAFETY ASSESSMENT

Goal

Assist aviation safety assessments through grounded analysis of regulatory documents.

Approach

- Retrieval augmented LLM architecture
- Hybrid semantic and keyword retrieval
- Structured regulatory knowledge base

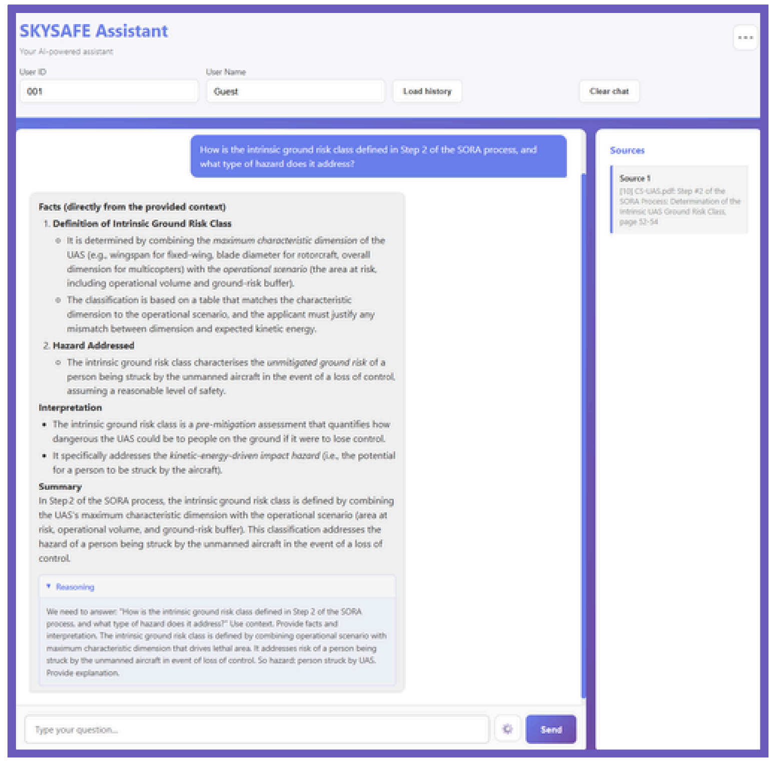


Key Capabilities

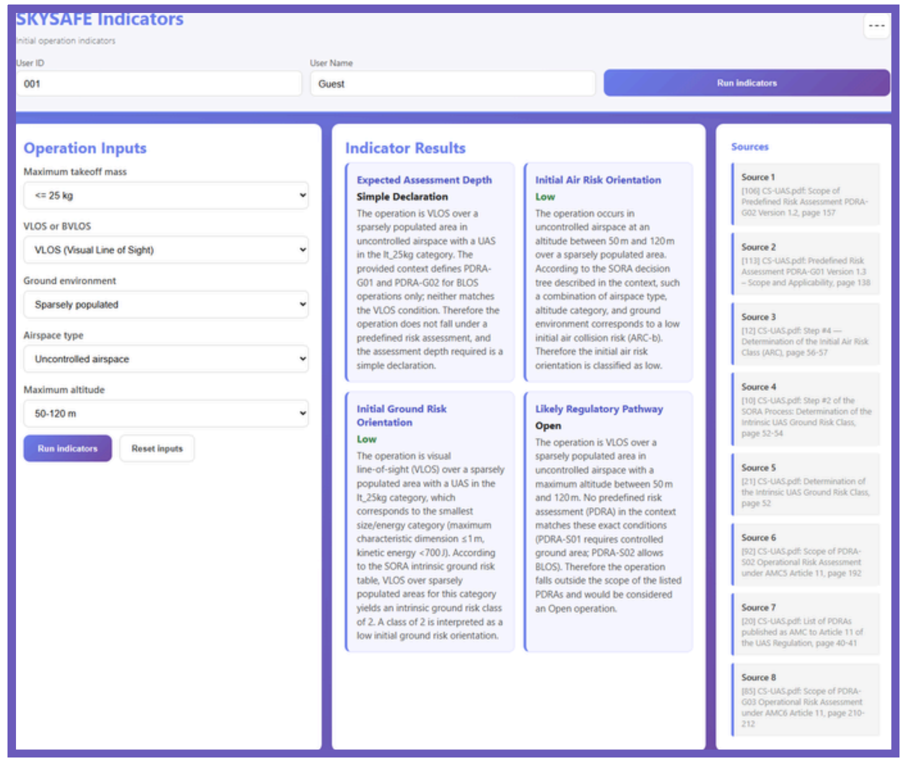
- Grounded answers with document citations
- Reduced hallucination through controlled retrieval pipeline

Applications

- Q&A



- Classification Task



PROJECT 3: REINFORCEMENT LEARNING

OPTIMISATION OF CONTROL POLICY AND TRAJECTORY

Goal

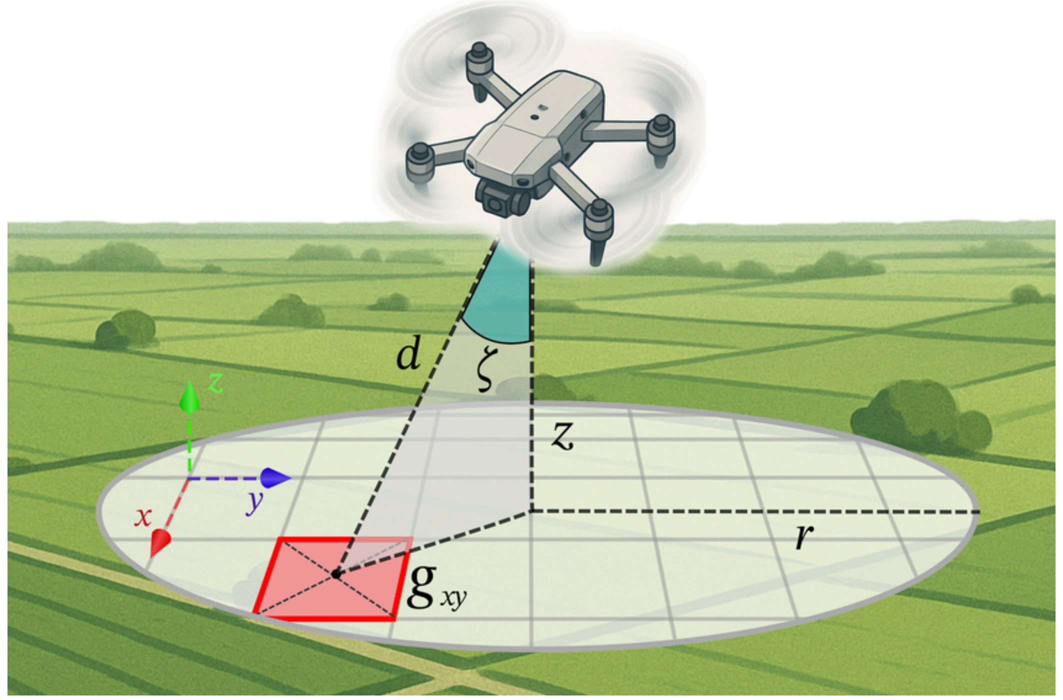
Optimise drone control policies and trajectories under operational and noise constraints.

Approach

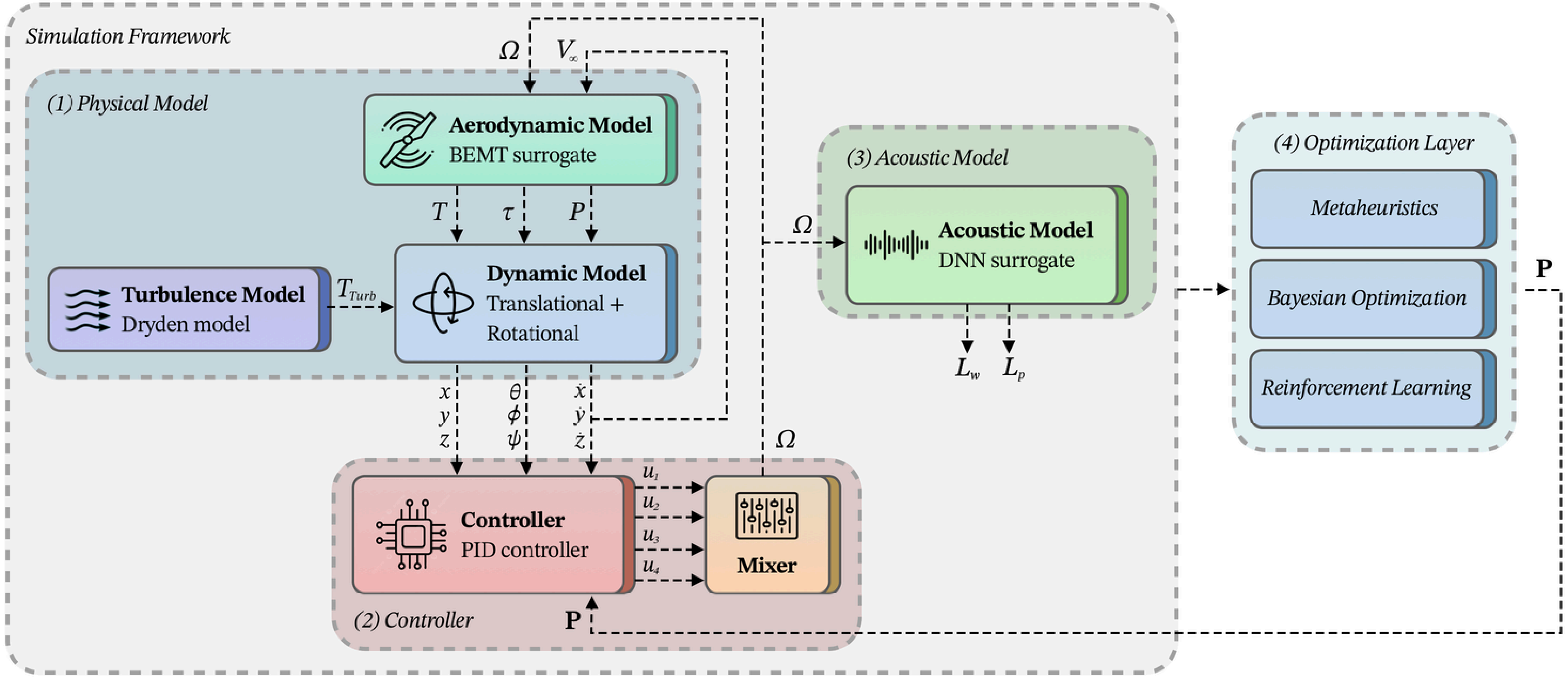
- Physics based flight simulation environment
- Reinforcement learning for control policy optimisation

Outcome

- Optimised flight trajectories satisfying operational and acoustic constraints
- Learned control policies for efficient and adaptive autonomous flights



Digital Twin Model



Optimisation Pipeline

WHY ME

Unique combination of:

- Aerospace engineering expertise
- Deep learning for physical systems
- Scientific computing and simulation workflows

Capabilities:

- Build ML models for engineering simulations
- Develop surrogate models for design optimisation
- Apply RL to control systems
- Build AI tools for aviation safety analysis

TECHNICAL SKILLS

Programming

Python
MATLAB

Machine Learning

PyTorch
TensorFlow
Hugging Face

Scientific Computing

CFD workflows
SU2
Ansys
Pointwise

Infrastructure

Docker
HPC clusters
Slurm
MPI
Git